MILITARY VEHICLES MAGAZINE'S

DODGE M37 Restoration Guide

Covers all 1951–1968 Military M37, M42, M43 & B1 Models

- Tips on Buying an M37
- How to Restore Every Key Item
- Complete Parts Catalog
- Over 250 Photos & Illustrations
- Make Your M37 Into a Daily Driver

By David H. Ahl

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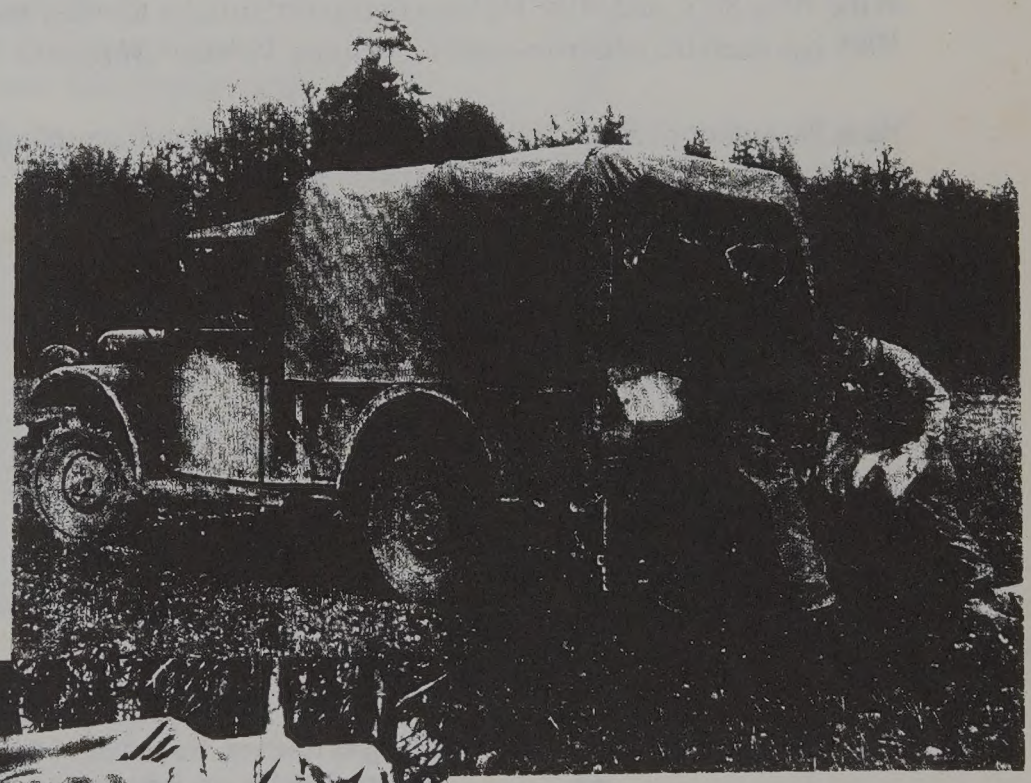

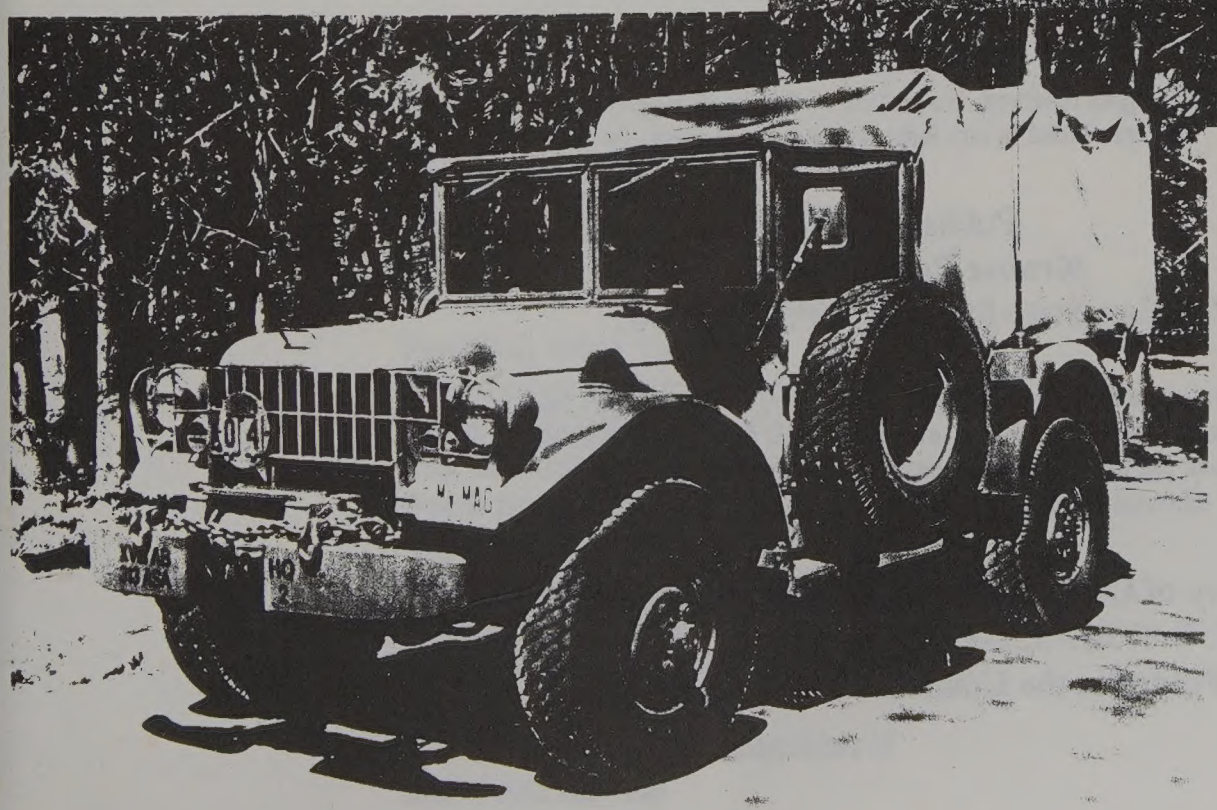

By David H. Ahl

Dedication

This book is dedicated to my loving wife Betsy, without whose patience, understanding, and help I would never have finished restoring the M37. Nor, probably, would I even have my sanity without her. She's the best!

The Author

David H. Ahl earned a masters degree in electrical engineering from Cornell University and an MBA from Carnegie-Mellon University. He served two years active duty as S2 of the 313th ASA Battalion, a support unit of the XVIII Airborne Corps at Ft. Bragg, NC. He worked for Grumman Aircraft, Management Science Associates, Digital Equipment Corp., and AT&T before founding *Creative Computing* in 1974, the world's first personal computing magazine.

He has been involved with vehicles since childhood, racing Triumph sports cars in the 50's, building dune buggies in the 60's, and hopping up, repairing, and restoring everything from motor scooters to diesel trucks in the 70's, 80's, and 90's. He has contributed articles to many motoring magazines over the years and since 1996 has been the editor-in-chief of *Military Vehicles Magazine*.

He is the author of *Basic Computer Games*, the first million selling computer book, as well as 21 other books, mostly in the computer field. He has also written more than 400 articles on technology, vehicles, marketing, travel, and investment analysis.

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Front Cover Photographs

The top black & white photo was taken February 12, 1958 at Swabish Hall, Germany and shows men of the 11th Airborne Division loading supplies into an M37 at a bivouac area as they participate in Exercise Sabre Hawk.

The bottom color photo is of a 1962 M37B1 after a ground-up restoration by David Ahl in 1997-98. It has a 4-color camouflage paint pattern as used by STRAC units.. It carries the markings of a headquarters vehicle in the 313th ASA Battalion, a support unit of the XVIII Airborne Corps.

Back Cover Photographs

1. David Ahl's award-winning 1962 M37B1 in an Independence Day Parade.

2. Typical M37 awaiting restoration by a loving owner. Most of the bits seem to be present except for the tail gate and front cowl.

3. Many fire departments bought M37s for $1.00 each under a government disposal program in the 1970's. Many of them are now being sold off. They have generally been well cared for and are good buys for a collector.

4. M43 ambulance is a member of the M37 family.

5. The M152CDN Panel Truck is similar to the M43 ambulance except it has four side windows and only one rear door. Only 1038 of these trucks were produced in 1954-55 in Canada.

6. A beefed up long wheelbase M56C cab and chassis was used as a basis for the No. 3 contact maintenance shop set consisting of a Hobart generator/welder, Davey electric motor driven compressor, and a large assortment of power and hand tools.

Photo Credits

Cover photos by David Ahl, Thomas Batha, Anne Herrmann, Gary Keil, Hugh Kennedy, Duane Miller, Brad Stratton, and the U.S. National Archives.

Interior photos by Betsy Ahl, David Ahl, Alan Bowes, John Headley, Phil Kern, Jeff Kiefer, John LaBusier, John McCleaf, Barry Moses, Dan Pinkham, Jim Richardson, Joe Silvers, Simon Thomson, and the U.S. National Archives.

PREFACE

This book is about the Dodge M37 series of vehicles, which I believe are among the most rugged, practical military trucks ever built. Over 115,000 vehicles in the M37 series were produced from 1951 to 1968 and with 50-60% of them still running today, it is the second most popular military collector vehicle (behind the Jeep). It is popular not only among military collectors but also off-roaders, contractors, and 4x4 enthusiasts. More than 5,000 M37s have been restored and more are being restored every year. This book is a hands-on, how to guide to buying, restoring, repairing, and operating an M37. It includes practical tips on mechanics, bodywork, and painting with over 250 photos and illustrations. It also includes a hard-to-find complete illustrated 40 page parts catalog and a comprehensive 13-page guide to preventive maintenance called "Be Your Own Inspector."

Production vehicles in the Dodge M37 series (military T245/T245A and T249 designation) include the M37, M37B1, and M37CDN (Canadian) cargo (pickup) truck; M42, and M42CDN command truck; M43, M43B1, and M43CDN ambulance; M56, M56C, M56B1, and M56CDN cab and chassis; M56/ACF Brill R-2 crash truck, M152CDN panel truck; M201 maintenance truck; and V41 telephone maintenance truck. Experimental, prototype, and low production vehicles include the XM152 panel truck, M283 long wheelbase M37, XM142 bomb service truck, XM195 field utility truck, MB-2 fire and rescue foam truck, XM708 dump truck, and XM711 wrecker.

SECTION I

This section consists of a series of articles, which appeared in *Military Vehicles Magazine*, describing my M37 project vehicle from bringing it home right through the entire restoration process.

I wrote the first article, "A Tough, Affordable 4x4," two years before actually buying a vehicle. The more I looked at different vehicles, the more I was convinced that an M37 was a good, practical choice not only for driving in parades, but for going on trail rides, hauling heavy stuff, and real off-road use. Look at the vehicle specifications on pages 10-11 and see if you don't come to the same conclusion.

The next eight articles describe the 18-month process of repairing, refurbishing, rebuilding, and restoring the vehicle practically from the ground up. Okay, I didn't actually remove the cab from the frame, but except for that, the restoration covered every square inch of the vehicle.

Following the "Project Vehicle" articles is a two-page handout sheet that I prepared to give people at parades, car shows, and static displays. I strongly recommend preparing a sheet like this for any vehicle that you drive or show. It answers most questions, it is something you can leave on the vehicle when you are not around, and it is a good way to promote the military vehicle collecting hobby.

Rounding out this first section is a summary of the costs of restoring the M37; it is a real eye-opener. And lastly are some photos of M37s as they were used in the military and a page of photos of some of the vehicle details that people seldom get right. Throughout the rest of the book, you'll find more photos of vehicle details that will help you get your vehicle right. On the other hand, if you buy an M37, remember that it is *your* vehicle and you can do anything you want with it. Some purists would like to demand that every military vehicle be restored exactly the way it came out of the factory, but in my opinion you can do whatever you want with your M37 to suit your needs and preferences.

A Tough, Proven, Affordable 4x4 Brought to You by Uncle Sam

by David H. Ahl

Okay, so what you'd really like to see in your garage is an M1 main battle tank, maybe an M24 Chaffee light tank, or possibly even a Mk 2 Ferret. But your normally understanding wife just isn't willing to mortgage the house and even you, in rare moments of honesty, have to admit to yourself that to pick up some firewood or get to that remote fishing stream, other vehicles will do the job. An M37 for instance. The M37, a ¾-ton pickup truck built in the 50's and 60's, is not only tough, reliable, and available, but also affordable. Sound interesting? Read on.

Brief History

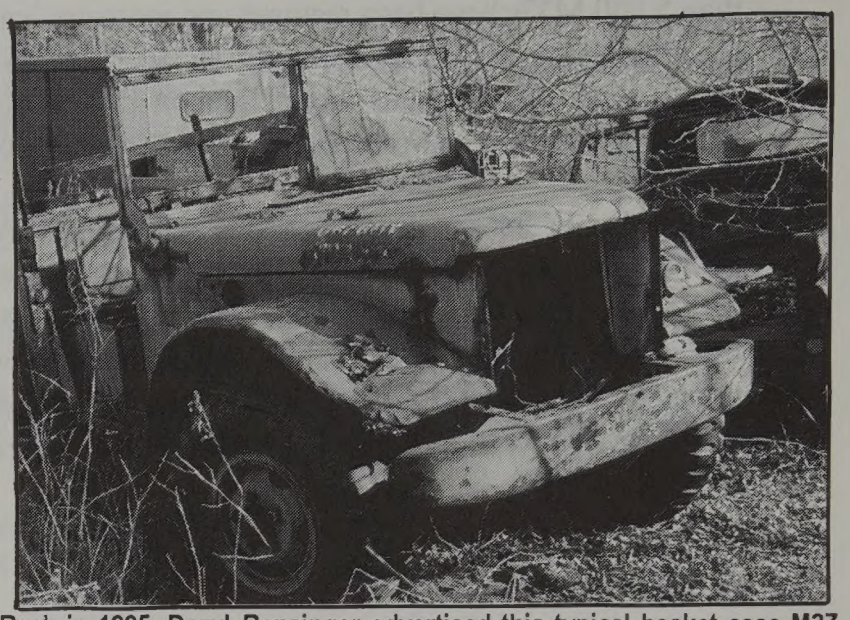
Several years after the end of WWII when the US economy got back into gear, the military began making plans to replace and upgrade its aging fleet of vehicles. High on the list was the replacement of the hastily conceived WC series of light tactical trucks built from 1941 to 1945. (Incidentally, WC does *not* stand for Weapons Carrier, but simply denotes the model series.)

In 1945, Chrysler had taken the ¾-ton WC military truck, modified the axle assemblies, tacked on different sheet metal, and introduced it to the civilian market as the WDX Power Wagon. The Army determined that a remilitarized version of this vehicle did not make sense and directed Chrysler to develop a new truck, later designated the M37.

This new design had major improvements over the WC series, in particular, better cross-country performance, easier maintenance, improved fording ability, greater driver comfort, narrower width, and lower height. The M37 went into final production in January 1951 and 63,191 vehicles were produced through August 1954. Seven USAF ambulances were produced in January 1955 and an additional 4,524 vehicles were produced in Canada between October 1951 and December 1955, thus bringing the total to 67,724.

In June 1957, a follow-on contract was awarded to produce an improved vehicle designated the M37B1. It had better wiring harnesses and connectors, improved brake cylinder cups and reflectors, magnetic drain plugs, and a revised canvas top. One modification, the use of a different alloy sheet metal in the body panels, seemed to make the B1 series slightly more prone to rust and corrosion than the earlier M37s, something to keep in mind if you're considering buying one. (Personally, having seen hundreds of M37s over the years, I've never noticed any difference—they *all* rust around the headlight wells..) Production of the new vehicles was delayed because the old drawings and specs had not been kept up to date and the tooling had been put in storage. Eventually, 47,640 of the B1 series were produced between April 1958 and June 1968. Thus, a grand total of slightly more than 115,000 M37-series vehicles eventually hit the road, more than half of which are still around today.

In the early-70's, the Army began to sell off surplus M37s, mainly to municipalities for rescue, civil defense, forestry, and other utility and/or off-road uses. Large numbers of M37s were sold in the early 80's to municipalities for $1 each, many of which subsequently came or are now coming on the market to the general public. Most of the vehicles sold by the Army had well under 20,000 miles on them and most local government users didn't add much, so the average M37 hitting the market today has well under 30,000 miles on it. So although they're old, they generally haven't had much wear and tear.



Back in 1995, Daryl Bensinger advertised this typical basket case M37 without doors, tailgate, radiator, or grill for $600.

Basic Specs

The M37 is a 4-wheel drive ¾-ton pickup truck with a flathead 6-cylinder 94 hp 230 cid gasoline engine, 4-speed transmission with 5.83 gears, 2-speed transfer case, 24-volt electrical system, and a 5' wide x 6' long bed. With the spare tire in its usual position behind the cab, the bed length shrinks to just over 5 feet. It has a gross weight of 8147 pounds (with winch) and can tow a 6000-pound load. Top speed is 48 mph and it guzzles gas at the rate of 9 mpg, which sounds dreadful until you consider that off-road it climbs a 60% grade without a wimper, has 10.8" of true ground clearance, 42" fording depth (*without* fording kit), and boasts off-road performance unrivaled by anything but a tank. At a recent military vehicles rally at Aberdeen Proving Ground in Maryland after a four-day downpour, it was the old reliable M37s, not the superstar Humvees, that were pulling out the military jeeps and civilian 4x4s that got mired down in 8" of mud.

The standard model M37 was a cargo truck with facing wood fold-down seats in the bed, a steel and wood framework for a high canvas bed cap, and a canvas roof on the cab. About 30% of all M37s were equipped with a power winch with an astounding 4 *tons* of pull. The addition of a map table and light along with celluloid windows in the bed top transformed the M37 into an M42 command truck. Several other variations were produced including an ambulance (M43) with a longer bed, steel bed cap and hinged rear door, M201 maintenance truck, XM152 panel truck, and M56 cab and chassis only. There are many other factory and in-service variations: crash truck, fire fighter, compressor truck, wrecker, and dump truck.

Another neglected M37 looking for a caring (rich) owner.

The M37 has a four-speed transmission coupled to a two-speed (1:1 and 1.96:1) transfer case. In the low range, first gear is unbelievably low, actually a fifth gear. Second and third are modest jumps up (actually the same as first and second in the high 1:1 range) and are well spaced for off-road use. However, when using the high range for highway use, fourth is a huge jump from third, which means that you can't easily shift down for passing or hill climbing without the danger of over-revving the engine.

In motion, the M37 is not a quiet vehicle. In low gear it has a menacing growl, while at highway speeds, the whine from the straight cut gears is something one has to get used to. With the standard 5.83 gears and 9.00x16 tires, the M37 has a highway cruising speed of 43 mph at 2500 rpm, about the healthy maximum for the old Chrysler flathead. You can push it up to nearly 50 mph at 2900 rpm, but at the expense of excessive heat, noise and wear.

What to Look For

So there are a few negatives, but you're convinced that an M37 would fit well in your garage. Where do you find one and what do you look for? Read on.

Most municipalities sell off their used vehicles periodically; you'll occasionally find an M37 in these sales. Better sources are the classified and dealer ads in *Military Vehicles Magazine* and *Supply Line*, a publication of the MVPA. You'll also find M37s for sale at many military vehicle rallies and shows held mainly from May through October.

You can pick up a basket case M37 for as little as $500. A frame-up restoration to original military specs can run as high as $15,000. Expect to pay between $1500 and $6000 for a solid, mechanically sound model; obviously, the more you pay, the less you'll have to do yourself (or have someone else do).

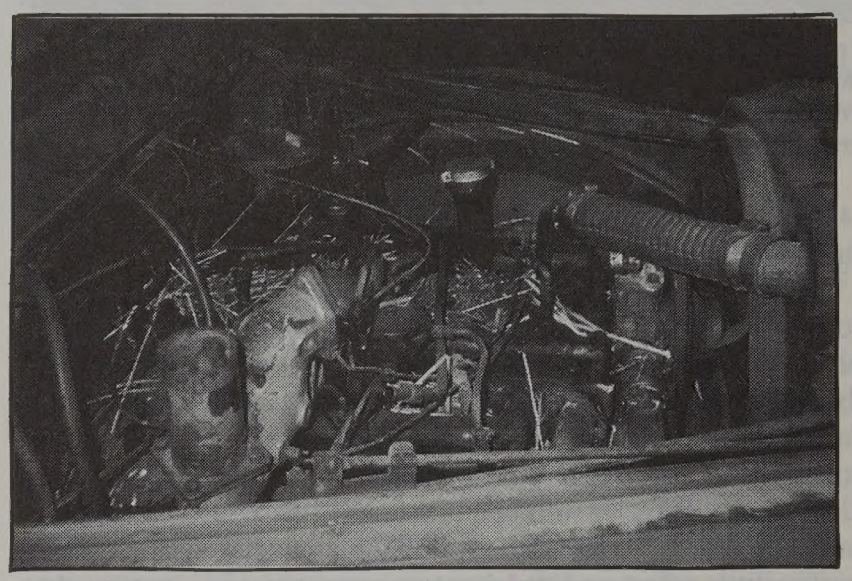
As mentioned above, most M37s have low mileage. The vehicles were well-maintained in the Army; you should check to see if the subsequent buyer was similarly diligent. For the most part it is not mileage, but age and storage conditions that are the major enemies. Thus, rust, dried rubber hoses and wiring, and deteriorated canvas are usually bigger problems than mechanical failures. Nevertheless, the M37 engine was not forgiving of over-revving and thrown rods were common.

Look for cracks in the exhaust manifold. When the reinforced rubber straps which hold up the muffler and tailpipe decompose with age, the entire weight of the assembly shifts to the exhaust manifold, causing it to crack and ultimately break.

You can expect to find rust on the body panels, doors, and in the bed. But spend some time poking around under the chassis with a screwdriver. Most of the main members are heavy enough that they won't be rusted through. An exception to this rule is the heavy brace in front of the doors to which the front fenders are anchored; road moisture often tends to transform it into a lacy spider web. The headlight mounting area is also a prime location for rust.

You should also look for rust in the radiator and for rust blockage in the water tube running the length of the block. While replacing or recoring the radiator is certainly possible, it's not something to look forward to.

Uneven cylinder compression or oil pressure below 50 to 60 pounds indicates fairly serious problems. Yes, you can get replacement gaskets, bearings, rings, and seals, but you're going to have enough other things to do to shape up a used M37 without having to worry about an engine rebuild.



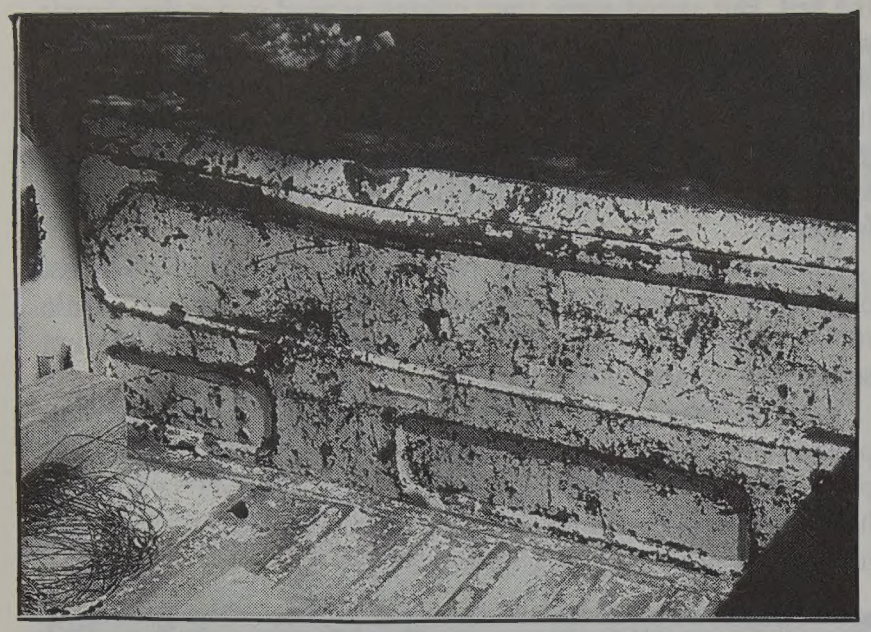
Lots of space under the hood without miles of emission plumbing or a baffling engine computer make it easy to work on the M37 engine.

One additional item to check is the dipstick—not for oil level—but to see if gas is leaking into the sump. The M37 uses a double action vacuum fuel pump; a cracked diaphragm leaks fuel into the sump, which in turn dilutes the oil, lowers pressure, and leads to other problems.

Making It Usable

If it hasn't been done already, the first absolute must is to replace the front wheel hubs with free-wheeling hubs (by Warn or Superwinch, about $125); this alone will gain 2-3 mpg and cuts down on drive train vibration. You can gain a few more mph by replacing the original 9.00x16 tires (which have a rolling radius of 16.6") with oversize tires (with a tube!). Up to 39.5 tires (radius 19.75") will easily fit in the large fender wells. The stock 7.5" rim will take a tire up to about 12" wide. Restorational purists will stick with the military non-directional treads ($105 each, $15 tube) which have next to no road adhesion on wet surfaces, but if you want to balance highway driving with off-road performance, you are well advised to get a modern all-terrain tread like the Denman Coyote A/P, Michelin XCL Radial, McCreary Condor Superlug, or Kelly Power King.

If you are truly discouraged by the lack of power and low road speed and have a few megabucks to spend on a cure, M.A.R.S. of Nashville, Indiana offers Hercules DT3.7 turbocharged diesel engine kits in 108 hp and 125 hp versions complete with everything from clamps to electric wipers to exhaust system (about $7,000 for the complete kit). Coupled with Richmond 4.89 ring and pinion differential gears ($318/set; two sets required for



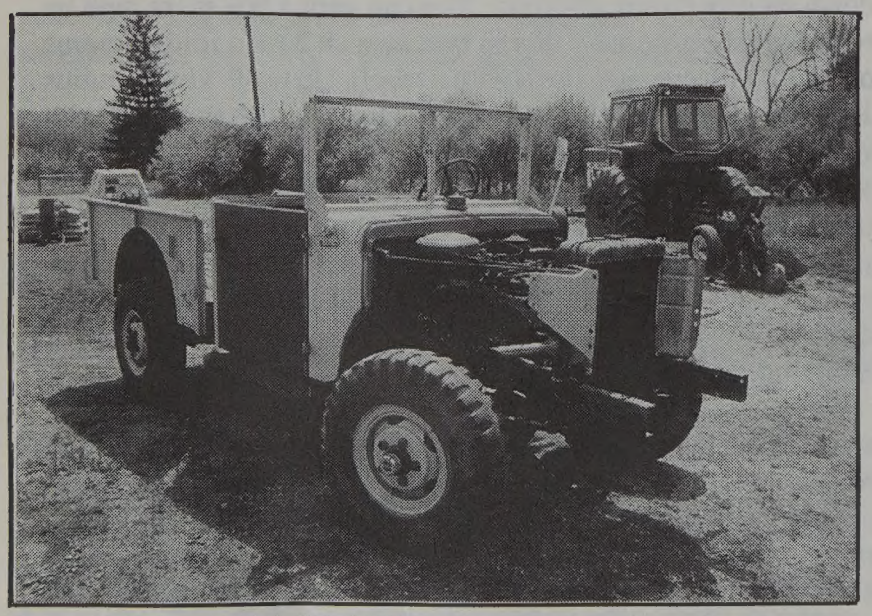
Tailgates of used M37s are typically in poor condition. It is especially difficult to repair the square column at the top if it has been badly dented. While other body parts are readily available, NOS tailgates are next to impossible to find on the surplus market.

4WD) buys you speeds up to 70 mph, 250 ft. lbs. of torque, and fuel mileage of 18 mpg plus.

Another reasonably direct engine replacement is the 1971 (only!) 360 cu. in. Chrysler passenger car engine. This is a small block 318 V-8 bored and stroked to produce 255 hp and 360 ft. lbs. of torque. Adding a pre-1971 water pump and flex fan cuts 1" from the length, which will allow it to fit into the M37 engine room without modifications to the radiator mount or firewall. Coupled to 4.89 gears, this combination will give you speeds of 65 mph and 16 mpg. There are several V-8 engine swaps that work with a little effort and at least two conversion kits are on the market.

Of course, it's possible to just replace the 5.83 gears with 4.89 ones and keep the original engine. This buys you a comfortable 52 mph highway speed, although you'll have to start more often in first and downshift more on hills.

Most owners are content to stay with the original engine, replacing parts as necessary. Two cardinal rules for the original flathead six: 1) don't over-rev (unless you'd like to see what a thrown rod looks like) and 2) for long trips, use a lead additive with your fuel. The M37 does not have hardened seats or valves and without a lead additive, you're just asking for a swallowed valve or broken piston.



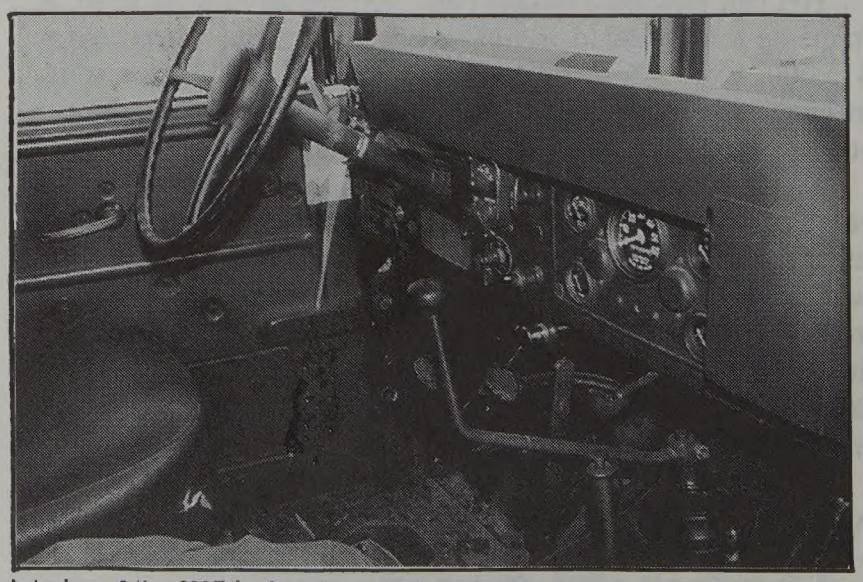
It may look okay, but this M37 still has a long way to go on restoration road.

Restoration of the author's M37B1 is just about complete. Here is the vehicle without canvas or spare tire. Camo paint is not usual on an M37 but is was used after 1976 on some vehicles that were still in service. Camo pattern is the same as used on the M715 1¼-ton truck.

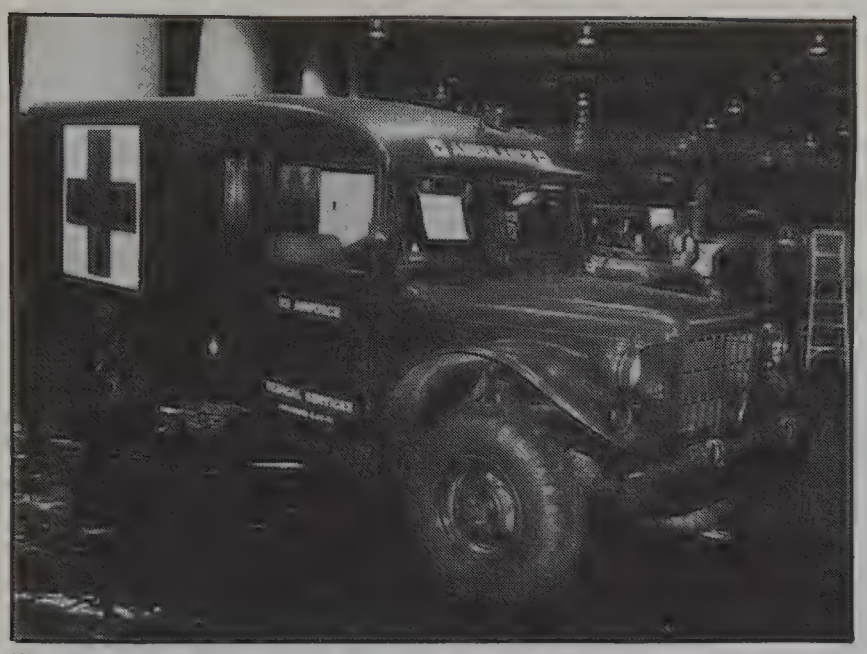
Be sure to keep the oil topped up; oil distribution is not nearly as good as in a modern engine and the entire crankshaft should be emersed in oil, particularly when starting up. Owners tend to have strong feelings about which type of oil is best. Some stick with the original specs which call for a single weight oil while others feel that a modern multi-grade detergent oil works just fine. Some owners swear by Slick 50 which is said to reduce friction when starting up. Personally, I feel that a premium-quality 10W-30 natural/synthetic blend is the best bet.

If it has not already been replaced, the original wiring is likely to have dried insulation and tenuous connections. You can still buy original replacement chassis, headlight, instrument, and 4-wire spider wiring harnesses which are called "new old stock" (NOS). However, I advise getting completely new wiring harnesses custom made to your own specifications. New plastic insulation will last much longer than the rubber insulation on NOS and the custom harness will take into consideration modifications you may have made for an electric fuel pump (recommended), spotlights, cab lighting, radio, and so on. NOS harnesses cost $50 and up; unfortunately, new custom harnesses cost even more.

With a gross weight over four tons, the M37 requires a lot of pedal pressure to stop. Thus, some owners add a Bendix hydrovac power assist ($150 or so) to the brakes. The engine compartment has plenty of room for the unit and it runs off the engine vacuum; it's an easy and worthwhile add-on. Disk brake kits and master cylinder upgrade kits are also available and are relatively simple to install.



Interior of the M37 is Spartan and functional. The sheet metal covering across the dashboard is an optional defroster.



The M43 was the ambulance version of the M37. This is Bill Brenner's award-winning 1954 M43 in Air Force colors as shown at the 2000 MVPA Convention in Kansas City, MO.

In 1953, 308 M56 cab-and-chassis vehicles with winch were supplied to the ACF-Brill Company to manufacture into U.S. Air Force R-2 Crash Trucks. They had a nitrogen-pressurized 20-gallon foam dispensing system. The structure of the roof housed a 20-foot aluminum extension ladder. This gorgeous restored M56 belongs to Mike Feathers.

Like most military vehicles, the M37 has a 24-volt electrical system. Using two 12-v batteries in series lets you tap off one of them should you wish to add light-duty 12-volt electrical accessories such as a radio, strobe light, or CB. For 12-volt accessories with a heavy current draw, you'll need a step-down device or some other arrangement that doesn't unbalance the charge on the two batteries.

In general, M37 drive train members are not interchangeable with other military or civilian vehicles. The Tracta front axle shafts, rear axle shafts, and third members were unique to the M37. The transfer case was also used in the M715 cargo truck and M725 ambulance built by Kaiser Jeep, but, in fact, M37 parts are far more readily available than Kaiser parts. Transmissions are generally interchangeable between M37, WC and pre-1957 civilian Power Wagon trucks.

If you've changed tires sizes or rear end gears, the speedometer and odometer will no longer read correctly. If this bothers you, you can get a used Stewart-Warner speedometer adapter (about $15) in a wide variety of ratios that mounts on the transfer case. It's tight, but the adapter *will* fit.

Before plunging into buying, repairing, or restoring an M37, spend a few hours with some armchair reading. I recommend the magazines mentioned above, two IPC Tech Manuals on the M37 if you can find them ("The Production Story" and "Power Trains and Interchanges"), and one or more of the four Dodge M37 manuals: Operation and Maintenance; Engine; Power Train, Body & Frame; and Complete Parts Manual.

The M42 was the command truck version of the M37. It has a map table, radios, and other gear in the rear. This is Tom Markert's meticulously-finished M42 at a WWII Memorial Fund Raising event in April 2000.

Sources

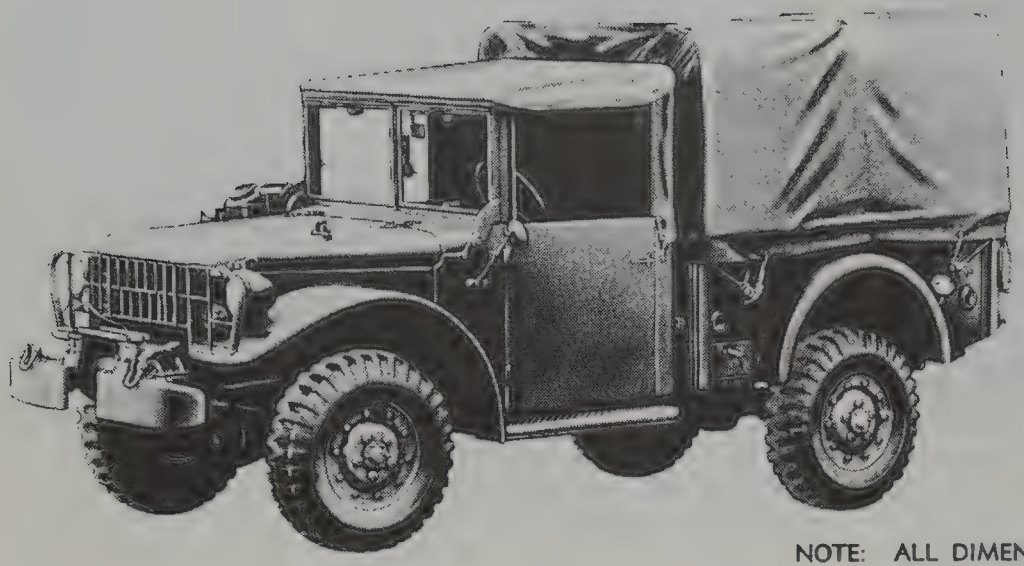
Magazines: *Military Vehicles Magazine*, 700 East State St., Iola, WI 54990, 800-258-0929 ($18 per year for six 160-page issues). *Supply Line*, Military Vehicle Preservation Association, P.O. Box 520378, Independence, MO 64052 ($30 per year membership).

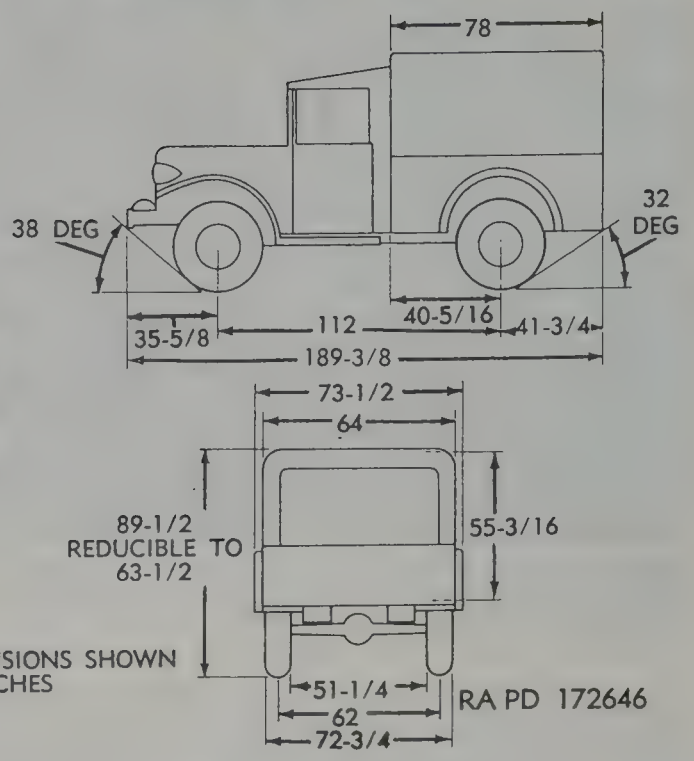
Parts: A number of vendors specialize in the M37, among them *Adirondack Dodge Parts*, P.O. Box 99, Prospect, NY 13435, (315) 896-2572, *Midwest Military*, 18351 Country Squires, Prior Lake, MN 55372, 612-440-8778, *Vermont Commercial Salvage*, 4 Belwood Ave., Colchester, VT 05446, (802) 864-4762, and *Vintage Power Wagons*, 302 S. 7th St., Fairfield, IA 52556, 888-695-0578. Diesel repower kits and 4.89 gears are carried by *M.A.R.S.*, 4712 W. Yellowwood Road, Nashville, IN 47448, (812) 988-2330. Disk brake, power steering, and V-8 adapter kits are made by *Helitool*, 6721 Old Stage Rd., Central Point, OR 97502, 541-664-8325. Larger military parts vendors such as Memphis Equipment, Antelope Valley Equipment, Rapco, Army Surplus Warehouse, and Second Armor also stock NOS (new old stock) and newly manufactured parts for M37s.

Manuals: *Portrayal Press*, P.O. Box 1190, Andover, NJ 07821 (catalog $3.00).

One of the rarest of all M37 variants is the XM711 wrecker. A commercial Ashton Company model 10-60-BW wrecking body with a telescoping boom was mounted on an M56B1 cab-and-chassis with a winch and ambulance-type spare wheel carrier. This XM711 was restored by David and Jim Bobik,

TRUCK, CARGO, ¾-TON, 4 x 4, M37, W/ AND W/O WINCH (Dodge)





NOTE: ALL DIMENSIONS SHOWN ARE IN INCHES

Technical Manuals: 9–840, 9–1840A, 9–1480B; 9–1825A, 9–1825B, 9–1826A, 9–1828A, 9–1829A, **Supply Catalog:** SNL G–741.

Classification: Standard.

Purpose: To transport general cargo.

GENERAL DATA

Crew 2
Weight (lb):
- Net 5,917
- Payload w/crew ..... off highway 1,500; on highway 2,000
- Gross ..... off highway 7,417; on highway 7,917

Live-axle gear ratio 5.83:1
Axle load (lb):
- Empty ..... front 3,251; rear 2,666
- Loaded:
  - Off highway ..... front 3,251; rear 4,166
  - On highway ..... front 3,251; rear 4,666

Tires:
- Ply 8 ..... Size 9.00 x 16; Pressure (psi) 45
- Tread, center-to-center, front ..... (in.) 62

Shipping dimensions, uncrated:
- W/winch ..... (cu ft) 515; (sq ft) 97
- W/o winch ..... (cu ft) 503; (sq ft) 95

Vehicle dimensions (in.):
- Ground clearance 10¾
- Pintle height, empty 25⅛
- Loading height, empty 29¾
- Body inside dimensions:
  - Length 78 ..... Width 64; Height 55 3/16
- Body cargo space ..... (cu ft) 160

Electrical system ..... (volts) 24
- No. of batteries ..... (12-volt) 2
- Type of ground ..... negative

Fuel octane rating 72

Capacities:
- Fuel ..... (gal) 24
- Cooling system ..... (qt) 25
- Crankcase, refill ..... (qt) 5
- Transmission (qt) ..... w/power take-off 5¼; w/o power take-off 4½
- Transfer ..... (qt) 2½
- Axles ..... (each) (qt) 3
- Winch ..... Oil capacity (qt) 1; load capacity (lb) 7,500

Brakes:
- Manufacturer; Dodge ..... Type; hydraulic
- Parking brake, type ..... transfer

GENERAL DATA—Continued

Transmission:
- Forward speeds 4
- Gear ratio ..... High 1:1; Low 6.4:1

Transfer:
- Speeds 2
- Gear ratio ..... High 1:1; Low 1.96:1

PERFORMANCE

Computed grade ability in lowest gear, loaded ..... (percent) 65
Turning radius ..... (ft) 25
Fording depth ..... complete submergence
Fuel consumption, loaded ..... (mpg) 9
Cruising range, loaded ..... (mi) 215
Allowable speed, governed ..... (mph) 55
Maximum recommended towed load ..... (lb) 4,000

ENGINE

Manufacturer: Dodge ..... Model T–245
Type ..... L-head, 4-cycle; No. of cylinders (in line) 6
Displacement ..... (cu in.) 230.2
Bore ..... (in.) 3¼
Stroke ..... (in.) 4⅝
Compression ratio 6.7:1
Governed speed ..... (rpm) 3,200
Brake horsepower (max w/ std accessories) ..... 78 at (rpm) 3,200
Torque (max w/std accessories) ..... 177 lb-ft at (rpm) 1,200

ADDITIONAL DATA

Live Axles, type ..... hypoid, full-floating
Transmission, type ..... synchromesh

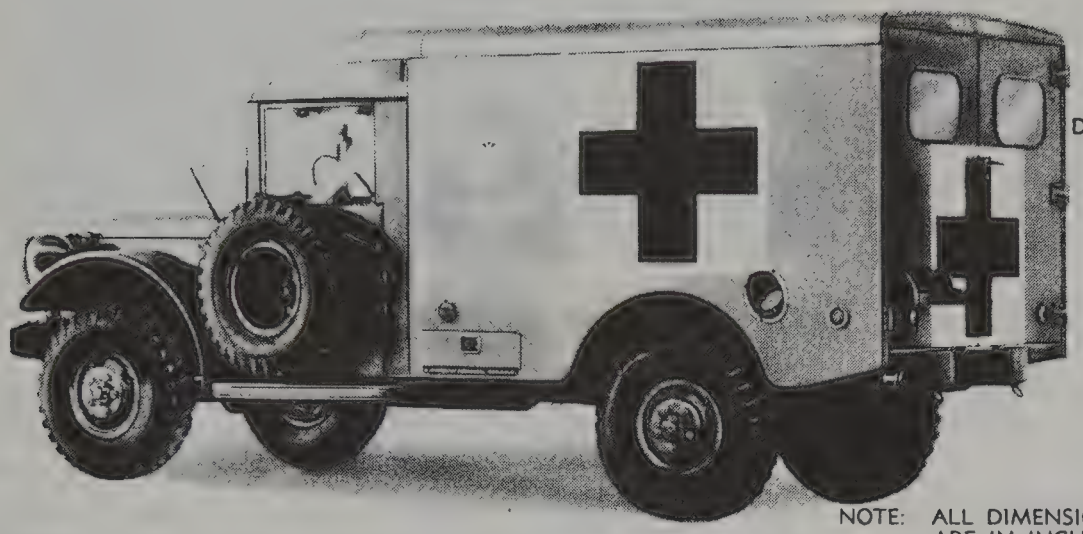
Data given for vehicle w/winch. Changes in data for vehicles w/o winch are as follows:

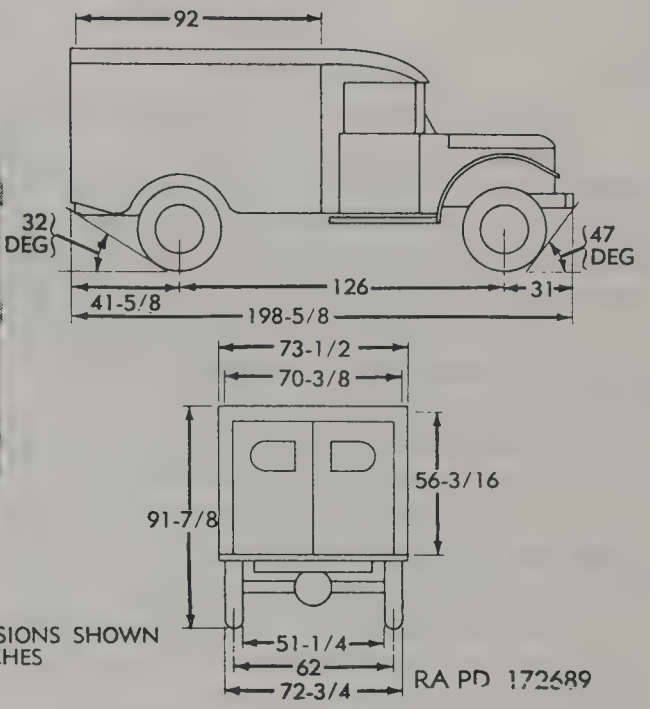
Length, over-all ..... (in.) 184¾
Weight (lb):
- Net 5,687
- Gross ..... off highway 7,187; on highway 7,687

Axle load (lb):
- Empty ..... front 2,981; rear 2,706
- Loaded:
  - Off highway ..... front 2,981; rear 4,206
  - On highway ..... front 2,981; rear 4,706

M37 Specifications as printed in Dept. of Army Technical Manual TM 9-2800-1, "Military Vehicles" February 1953

TRUCK, AMBULANCE, ¾-TON, 4 x 4, M43





NOTE: ALL DIMENSIONS SHOWN ARE IN INCHES

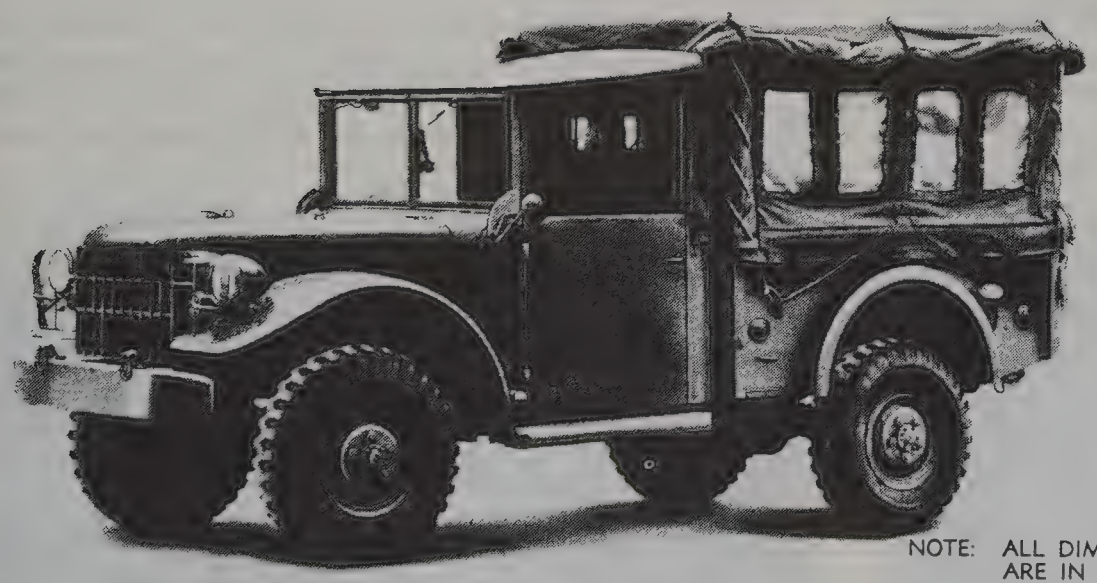
RA PD 172689

Technical Manuals: 9–840, 9–1825A, 9–1825B, 9–1826A, 9–1828A, 9–1829A, 9–1840A, 9–1840B; **Supply Catalog:** SNL G–741.

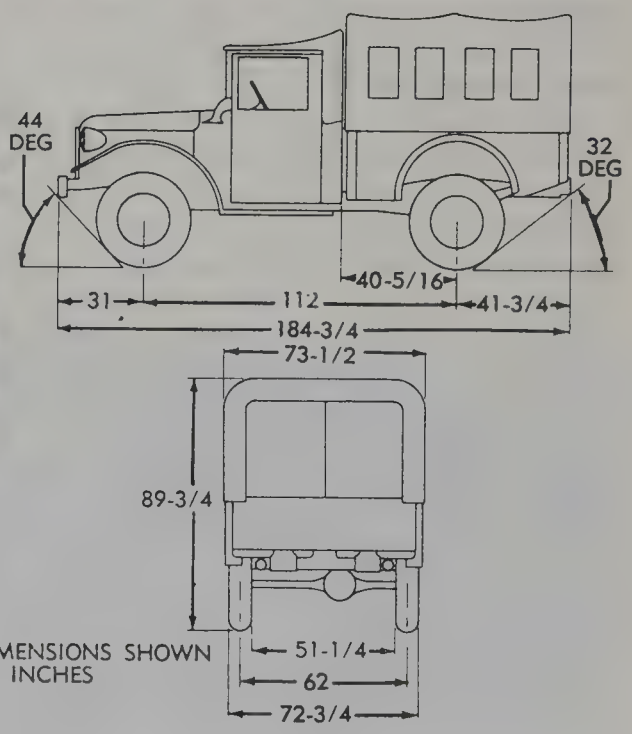
Classification: Standard.

Purpose: To transport sick and wounded personnel.

TRUCK, COMMAND, ¾-TON, 4 x 4, M42



RA PD 172653



NOTE: ALL DIMENSIONS SHOWN ARE IN INCHES

Technical Manuals: 9–840, 9–1825A, 9–1825B, 9–1826A, 9–1828A, 9–1829A, 9–1840A, 9–1840B; **Supply Catalog:** SNL G–741.

Classification: Standard.

Purpose: To transport command and reconnaissance personnel and light cargo.

M37 Project Vehicle

by David H. Ahl

When did it all start? Well, it's hard to say exactly, but over the past three or four years I've come to realize that there ought to be an M37 in our garage. Three years ago, I sold our "extra" car so we had the garage space. But between my son saying he felt an M37 was kind of clunky and my wife saying that she'd like to be able to drive it to the garden center and me thinking that power steering and air conditioning wasn't really *that* decadent, the M37 turned into a Sonoma pickup.

Well, today, my son is off on his own in New Hampshire, my wife is editor of this rag, and for me the magic of air conditioning has worn off, so, except for the lack of garage space, we just have no excuse not to own an M37. More important, the magazine *needs* a project vehicle.

So back in early November I put the word out, started scanning the ads and auction notices, and seriously started to search for a vehicle.

A week later I'm in Stroudsburg and Guenter Ctortnik is trying to convince me that really a WC52 would make a much better project vehicle than an M37. And he just happens to have two of them for sale, one beautifully restored and the other in need of some TLC. I listen to him, drive the WC52 that I can afford, and try to think about what makes the most sense.

That's always a good thing to do when buying a military vehicle: think about what you really want to do with it. In my case, I'm buying a vehicle to use. I live on a nasty hillside in a micro climate pocket (no kidding) that is ten degrees colder and gets more snow than most of the rest of the state. I want a vehicle to get me around in the winter. I also go to rallies and swap meets and shows and I want a vehicle to haul heavy cartons of magazines, vehicle parts and accessories, and lots of other heavy and/or dirty stuff. My son lives near a class 6 road in New Hampshire and thinks his Nissan 4x4 is the only way to go. I want to show him how to get to the places where his toy truck won't go.

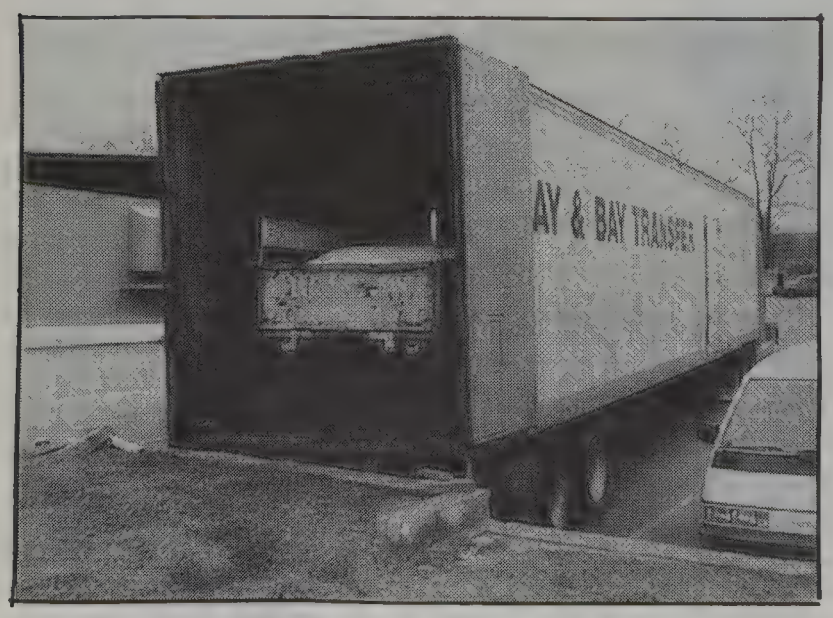
So, I'm not buying a vehicle to restore it to look like the day it came off the assembly line. I'm not rebuilding it to put it on a trailer to take it to a show and enter in the master class or even the restored class; *maybe* I'll enter it in the motor pool class or, better yet, the combat class. And maybe I'll drive it in the 4th of July parade. These objectives may change over time, but that's where they stand today.

Once I thought this through, I felt better about my decision to get an M37. Practical, no-nonsense, affordable, and, best of all, it would meet my objectives.

A week later, Rick Frei, a local MV club member calls me, "hey, Dave, there's an M37 on Main Street in Blairstown for sale cheap." I drive out to take a look. Faded blue, decent sheet metal, no canvas, no radiator, no windows, no cab floor, no seats, and no front grill or bumper. Rough, very rough. Asking price $1100. It looks like a good parts vehicle to me worth maybe $500. A week later I hear it sold for $1200. The buyer obviously saw something I didn't. Or maybe not.

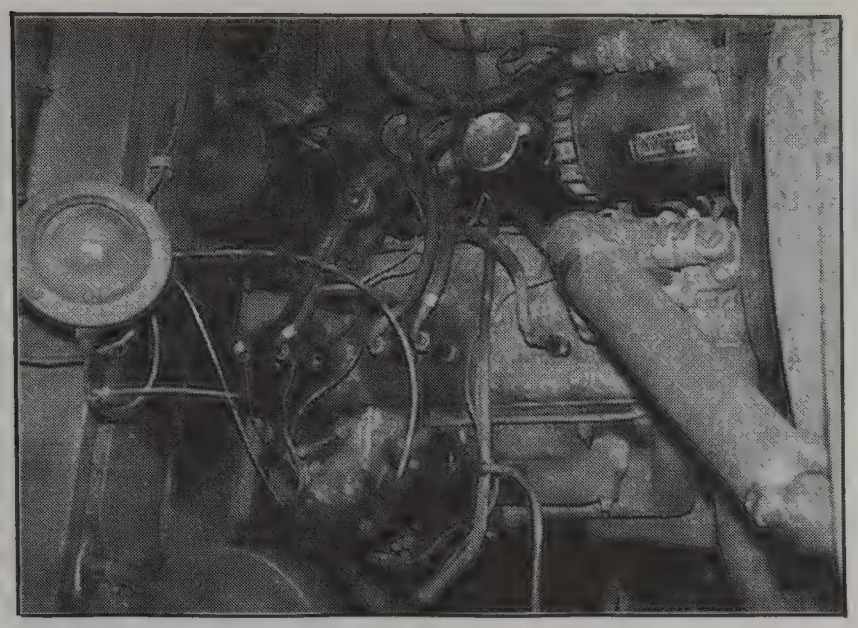
On November 21, I talk to John Bizal at Midwest Military about the Red Bud sale. I mention that I'm looking for an M37 and he says he has six on his lot, two real rough, three okay, and a nice B1 with a winch. It's an ex-fire department brush truck, bright yellow, in great shape, and the price is right. I say, "that's nice, John, but getting an M37 from Minnesota to New Jersey is going to cost as much as the vehicle." He tells me he just shipped a vehicle from Minnesota to Arizona for $600 and offers to send me a video of the truck.

A day later, Bruce Brooker, a reader in Florida tells me he has an M37 for sale. "It's perfect for you," he says, "it's got power steering, custom cab, Super Swamper tires on new Dodge wheels and, best of all, the bed is raised to make room for the stereo amps and speakers." Bruce had put over $10K into it and only wants $8K for it. I tell Bruce that it's



The M37 arrives in the back of a 40' semi-trailer.

An expensive way to bring 50 cu. ft. of snow from Minnesota to NJ.



Except for some rust and grease, the engine looks pretty clean.

not quite my bag.

December rolls around, I get caught up in the holidays, and the search for an M37 goes on the back burner.

In early January, John's videotape arrives. The tape is very comprehensive; John has walked completely around the vehicle pointing out good points and flaws. Then, from a distance, he's taped the vehicle in motion. But there's still the problem of getting it the 1200 miles from Minnesota to New Jersey.

I call some vehicle movers and put a want ad on the TruckNet web site; Horseless Carriage wants $1050 for the move, Auto Driveaway wants $950, and a broker thinks he can get someone to move it for $850. Still a bit pricey; John's M37 only makes sense if I can ship it for under $700.

Then I happen to notice an ad in the New England MVCC newsletter for an M37 just released from a local fire department. Eric Briggs wants $2600 for it, a fair price, and tells me the only things wrong with it are a pinhole leak in the gas tank and leaking brake cylinder. Moreover, he and his partner are willing to deliver it to New Jersey from Rhode Island cheap. Eric sends me to photos of this bright red vehicle. I'm leery of doing a quickie patch on the fuel tank; that's something you don't want to mess with. I get a ballpark quote to pull out the tank, send it off for repair/rebuilding, and reinstall it: $250 minimum, probably more. Not onorous, but something to be factored in.

I talk to Bob Stahl at Veteran Vehicles up in Wrentham, Mass. about maybe installing 4.89 gears in Eric's M37 since it's just 30 miles from his shop. He's enthusiastic and sends me a quote for rebuilt third members with Richmond 4.89 gears, bearings, new seal and seal surface, complete for $650 each (there are two in an M37). Installation is another $300. I get to thinking that maybe this is something I don't want to do right away.

A week later, my feelers begin to pay off and three other people call me with M37s for sale. Barry Moses up in Kingston, New Hampshire has several and sends me photos of two of them. A blue one with arctic cab looks real nice, although it doesn't have a winch.

Three others surface, but none is quite right. Then on Feb. 4, I get an urgent call from John Bizal. He's found a trucker deadheading back to New Jersey who's willing to take the M37 for $650. He needs to know right away if it's a go because the trucker is leaving the next day.

Pricewise, it sounds good except I don't have a place to unload the vehicle. So I call John Headley at Doncar. He has a Tagalong trailer and figures that using some wood blocks we can bounce the M37 from the 4' truck to his 2' high trailer, and then to the ground. Any day is fine except Friday.

I call John Bizal back and say, "okay, ship it." John says, "fine, but it will arrive on Friday. The trucker has to pick up a load on Saturday." Back to the telephone. I call some moving companies to see if I can borrow some vehicle ramps. No dice. I check on some loading docks, but no one has as way to get a vehicle (the M37) off once it's unloaded. I then call Ray Bentley who has a fantastic collection of tanks; I figure he has to have some way to unload them. Ray says, sure, he has a dirt ramp and I'm welcome to use it. Whew!

I fax John a map to Ray's place, the trucker loads up on Wednesday afternoon and arrives in Ledgewood, NJ at 4 p.m. Friday. He raises the tailgate, the M37 starts right up, and we back it out of the van and down the ramp. John has thoughtfully left 30" of Minnesota snow in the bed, none of which has melted on the 1200-mile trip.

The title arrives in the mail Monday and I start the New Jersey paperwork nightmare. Under the new, streamlined,

Bright yellow color, broken window glass, missing mirrors, and holes for lights and sirens reveal a bit of its former life.

Your editor smiles at the thought that she will not be the one stripping the paint off this beast.

private-contractor DMV, to get a NJ title, insurance, registration, and plates takes a minimum of three weeks. No joy.

What is a Project Vehicle?

Just what do we expect to do with the M37 at the magazine? Basically, we'll be fixing, restoring, and rebuilding it system by system and running in-depth step-by-step photo articles of exactly what we did. Many of the systems that we'll be dealing with have applicability to other vehicles, not just the M37; for example, brakes, winch, body, wiring, ignition system, clutch, etc. We'll be looking to readers and advertisers for help in their area of expertise—not necessarily to work on the vehicle itself, but to give us tips and pointers of the best way to perform an operation or what to look out for.

Here are some of the things we expect to be doing over the next few issues (months):

Immediate Needs

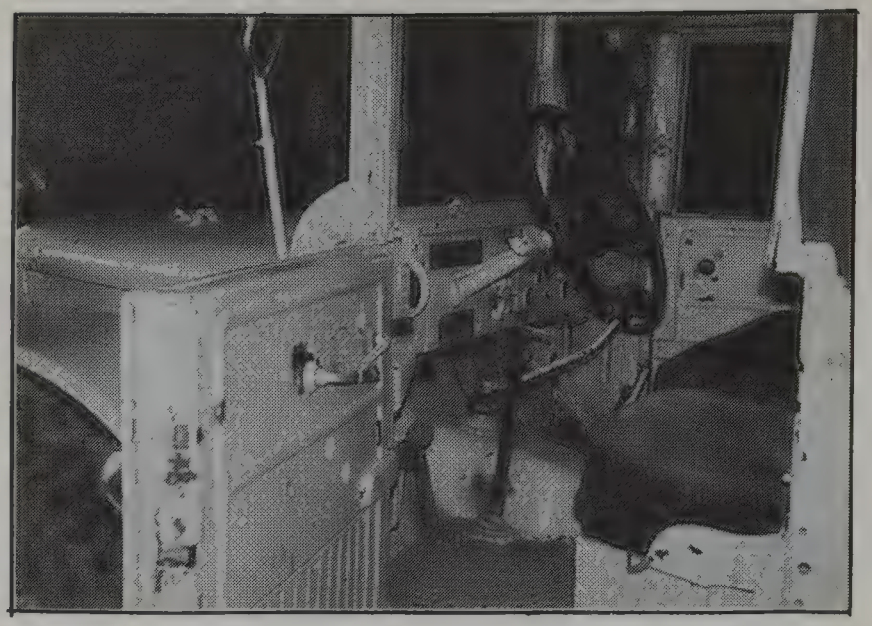
- Tune up, lubrication, complete inspection
- Adjust emergency brake (does not hold); rebuild entire brake system if necessary
- Repair door opening mechanism (driver door does not stay closed, door handle doesn't work) & window cranks
- Replace windshield and door glass (both broken)
- Repair winch (PTO handle does not go full forward, thimble is missing, chain is not attached)
- Install front locking/free wheeling hubs

Next Steps

- Replace deterioated canvas on cab and seats
- Obtain/make bed seats and bows; canvas for bed
- Major body straightening (fenders, running boards, tailgate), patch holes where fire department lights and sirens were attached
- Refurbish and/or replace wiring; add 12-volt accessory circuits, refurbish directional signals
- Sandblasting and painting (Camo? Unit markings?)

Down the Road (Maybe Projects?!)

- Change from 5.83 to 4.89 gears
- Put sound deadening insulation in cab
- Coat bed with non-skid lining material
- Add power steering



The interior needs serious attention from missing window cranks and glove box door to dangling wires to leaky canvas.

In the 1970's, the military had a program under which they sold M37s to municipalities and local government units for $1.00 each. Under this program, many fire departments bought M37s to use as brush fire trucks. As fire departments replaced these vehicles, they were sold off at auctions and private sales. Thus, there are many M37s around such as these that still carry fire department markings. M37s that belonged to fire departments have generally been well cared for and are good vehicles for restoration. The M37 on the left is a daily driver that belonged to Barry Moses in Kingston, New Hampshire. The one on the right was subsequently restored by John LaBusier of Asshley, Illinois.

Bringing It Home

In which we discover why the handbrake doesn't work

by David H. Ahl

You'll recall in our last issue, on February 7 our M37 had been delivered to Ledgewood, NJ where Ray Bentley had kindly offered me some garage space for the vehicle until the paperwork was completed.

The very next day, I get a quote from one of the leading historic car insurance companies. I figure I don't need much coverage but their minimum for any vehicle in New Jersey is $50. They require copies of my existing insurance policy, current title, and a photo of the vehicle.

The following week I get a chance to read a 700-page novel sitting at DMV waiting to pay the sales tax and get the title transferred. Registration and plates for a historic vehicle have to come from Trenton, so I send in the application and fee. It's worth getting a historic vehicle registration in New Jersey because it's good for three years and exempts you from the mandatory annual vehicle inspection.

The weather is not cooperative, so it takes me another week to get back to Ledgewood to take the photo required by the insurance company. The M37 is in the back corner of the garage, so I use flash, which really emphasizes the rusty spots and places where sirens and lights had been removed against the bright yellow paint. I figure it doesn't matter; hey, I'm not applying for collision insurance.

I submit the insurance application and after ten anxious days, I find out that the photo really does matter. Insurance coverage is declined based on "condition of vehicle."

So I apply for insurance to another company through my regular local agent; I use a different photo taken outdoors (no harsh flash) from a more becoming angle. No problem; they approve the insurance the next day and fax me the NJ insurance card. It's three weeks now, but still no word from the DMV black hole in Trenton.

Finally on April 3, six weeks after submitting the application, the plates arrive with a temporary registration good for 21 days. I get my first choice of plates: MV MAG. A week later, the regular registration arrives.

We have a spate of late snow followed by rain, so it is not until April 15 that I finally get over to Ledgewood to drive the M37 the last 15 miles to its new home in Morristown. The vehicle starts right up, I put in 5 gallons of gas, and we set out on the highway, me in the lead, Betsy following with blinkers ablaze.

The minute I hit the highway, I make an important discovery, namely that a vehicle that idles nicely does not necessarily run nicely. Top speed with pedal to metal is 35mph and I seem to be running on fewer than 6 cylinders; 5 maybe, or is it 4?. Going up hills is a real trial; there is one particularly twisty 2-mile long hill where my 12-15 mph speed gathers a following of at least 20 unhappy motorists.

Going down the other side, I take a deep breath of relief—no, it isn't relief that I'm breathing, it's steamy coolant coming from an overheated radiator. I pull to the side, open the hood, and there, hanging limply over the fan pulley, is the fan belt. I stagger to a gas station about a half mile on. He, of course, does not have a replacement belt so we put the stretched and cracked belt back on in reverse, fill up the radiator with coolant, and I crawl the rest of the way home.

Toward the end of the trip, I notice that I seem to have less control. I attribute this to potholes and broken pavement, but when I park at the top of my driveway, one tire looks low. It's late afternoon, I have a softball game to play (we lost), so I don't think about it any further. And then I come home and find the tire completely flat.

The next day, I pump up the spare, cross my fingers, and change the tire. I discover that when a tire is so flat that the vehicle must be raised more than a foot, two jacks speed the job (pump one to its limit, put down some blocks or boards for the second jack and then pump it to its limit, and so on.)

With the tire changed, I decide the first thing to do is adjust the emergency brake. The hill where I live is no place to be without one. I familiarize myself with the procedure, slide under the M37 armed with wrenches, Vise Grips, and Liquid Wrench. I look at the brake assembly on the transfer case and think, "this doesn't look anything like the illustration in the manual." Lo and behold, the brake drum and brake linings are completely missing! No wonder the emergency

Both front bumpers are badly bent, the winch top cover, winch brake, and windshield catches are missing, the right headlight guard is misshapen—and then there are the dings, dents, and rust—all of which make this a truly wonderful, and typical, project vehicle.

brake didn't hold; it ain't there.

Okay, so that's a setback, but at least I can take out the broken window glass from the passenger door and get it replaced. I follow the instructions in the manual to remove the glass, but funny, when I try to crank the window down, it doesn't move. I shove it by hand—down to detach the various parts and up to remove it from the door—and finally get it out. I reach into the bottom of the door to retrieve a regulator arm retainer that dropped off. What's this? I find pieces of wood and all kinds of hardware: clips, gears, brackets, etc. No wonder the window doesn't work; most of the mechanism is in the bottom of the door frame. Another setback.

The outside driver door handle doesn't work and the inside handle has only a few degrees of travel, which moves the latch less than 1/8". I mess with it for a while and finally get so frustrated that I decide to just make a "to do" list of things to be done, actually four lists: body problems (27), engine and mechanical problems (11), missing vital parts (11), and missing nice-to-have parts (13). All of a sudden the bright yellow paint on every square millimeter of the vehicle is looking like the least of my worries.

Although the vehicle has just over 8,000 miles on it, judging from the misshapen front bumpers (hey, they're not easy to bend) and headlight guards, and the broken doors and glass, they were real tough miles. So our project vehicle looks like it may provide projects for many months to come.

At the COMVEC MV Show, I buy an NOS passenger door from Fred Potter of Adirondack Dodge Parts and repair the driver door (see box).

TIP: Interchangable door latch parts

I cannibalize the latch spring from the old passenger door latch mechanism for my driver door. Keep a pointed nose Vise Grip clamped around this puppy if you decide to remove it! People told me that the springs are not interchangable. Not true; the latch mechanisms are mirror images of each other so to be used on the opposite side the spring just has to be flipped over. From the driver door, I remove and clean up the latching mechanism with a stiff wire brush and liberal quantities of Gunk degreaser and Pure Strength cleaner. I reassemble it with the passenger door spring (flipped over), apply some stick graphite and a little 30 weight oil (you don't want to use thin handy oil oil or WD-40 on a semi-sealed device), reinstall it, and the latch is as good as new.

I still need some fuzzy strips for the windows, but at least my driver door stays closed on its own without a bungee cord and a prayer.

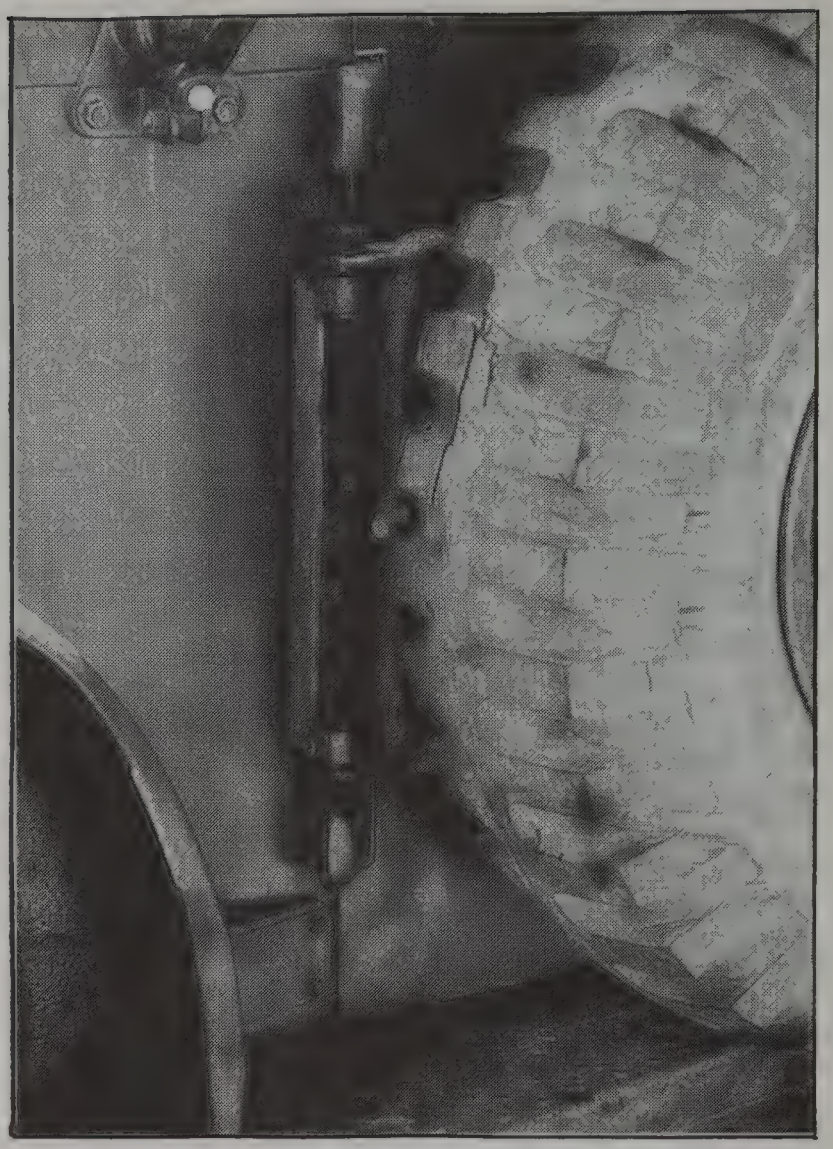
Readers: We need your help.

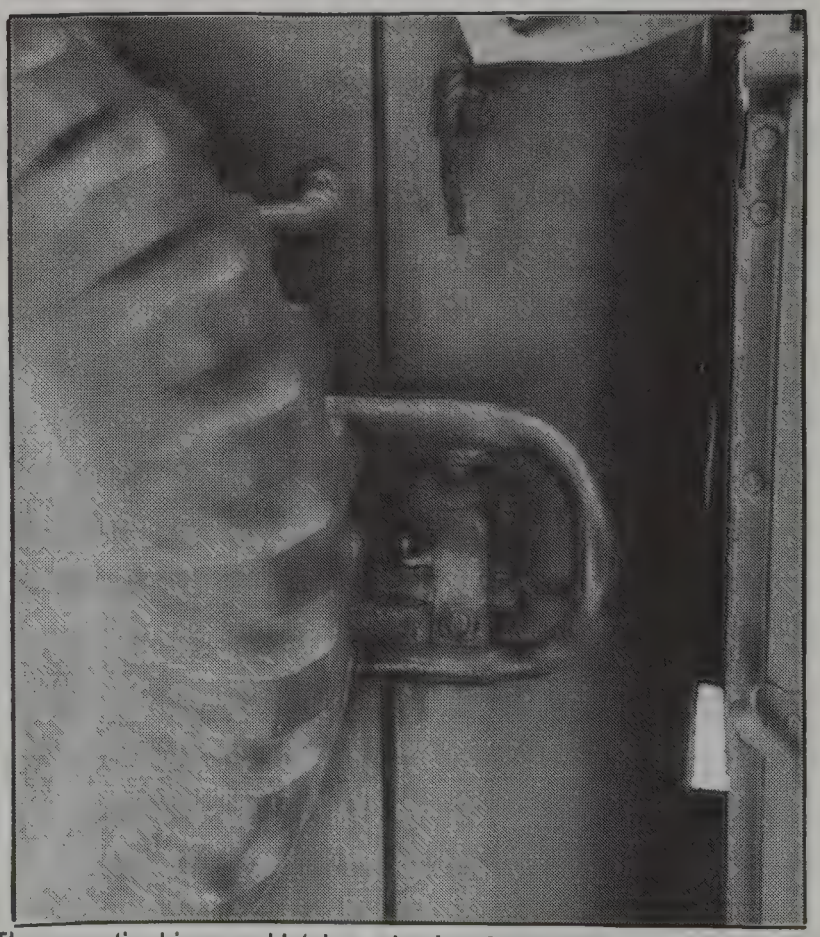
Question: We used to shave the heads and/or use thinner head gaskets on 50's vintage flathead Fords all the time to increase the compression ratio (and power). Has anyone done this with an M37; if so, what were the results?

Question: Has anyone used the two-carb intake manifold? What were the results? Are they still available?

Question: Has anyone used Rhino or other paint/spray no-slip linings on the bed? Do they work? How do they affect the removable access panels?

Got answers? Write to me, Dave Ahl, at Military Vehicles.





The spare tire hinge-and-latch mechanism for all M43 ambulances and all B1 model vehicles mount on the driver door. This puts a great strain on the door frame and makes it difficult to use the driver door. Nevertheless, it adds a certain pizzaz to the appearance of the vehicle. NOS door mounted spare tire mechanisms are very difficult to find, so if you find one in any condition (like my rusty one here), keep it and refurbish it.

PROJECT VEHICLE ...

Improvements for Your M37?

by David Ahl

Not much doing with our M37 project vehicle this issue other than the installation of a much-needed new emergency brake (see article elsewhere). For five weeks the bright yellow truck served as a billboard for our church's vacation Bible camp, the theme of which was "Kids Under Construction."

However, our previous articles prompted a number of readers to write about various aspects of restoring M37s.

Shaving M37 Engine Heads

In the last issue, I asked if anyone had any experience shaving the heads of the 230 cid L-head engine in the M37. The Dodge T245 engine has a 6.7:1 compression ratio. In TM 9-2800-1 (2/53) it is listed as having 78 hp at 3200 rpm whereas in the M37 manual, TM 9-8030 (5/53), it is rated 94 hp at 3400 rpm. Go figure. In contrast, that same engine in civilian trucks had the following specs:

Year	*Hp*	*Torque*	*RPM*	*Compression*
1948-50	102	184 lb/ft	3600	6.7:1
1951-53	103	190	3600	7.0:1
1954-55	110	194	3600	7.25:1
1956	115	201	3600	7.6:1
1957-61	120	202	3600	7.9:1
Military	94	177	3200	6.7:1

The stroke of the military engine and the civilian engine through 1953 is listed as 4.875"; thereafter the stroke is 4.625" suggesting a revised crankshaft in civilian engines after 1953.

As far as increasing the compression ratio, the responses I got ran the gamut from "don't do anything; you'll only gain about 5% power which you'll never notice" to "I shaved my heads and what a difference!"

An extreme case was a reader in Tennessee who had access to a NASCAR team's engine facility. He did absolutely everything possible: deburr, overbore, and hone the block; grind, chrome, polish, and balance the crankshaft; polish and balance the rods; shave and port the heads and install hardened valve seats; grind a more radical camshaft; and balance absolutely everything. He also put on dual carbs and raised the governor limit to 4000 rpm. He guesses that he's now getting between 140 and 150 hp with a corresponding increase in torque.

In the June 1997 issue of *Power Wagon Advertiser*, Michael Leach of Lynchburg, OH, notes that he overbored his block 0.030 and shaved his head to achieve a compression ratio of 8.0:1. He also installed an improved cam and valve spring set and balanced the rotating assembly. Before the rebuild, the truck could pull a 5,400 lb. trailer in high gear; after it could pull a 9,000 lb., trailer thus demonstrating a substantial increase in torque.

In a letter, Don Kein of Geneva, IL, notes that by simply milling 0.080 to 0.090 from the head, he gained a noticeable increase in performance.

George Burk of Indianapolis feels that rather than shaving the head, one would do better to locate a later head from a civilian truck. He notes that he measured the chamber volume of two M37 engines and found as high as a 15% variation across a single head. This suggests to George that if you are going to mill a head, you should try to find a flat one with nearly identical chamber volumes. Nice advice, but how many people have five or six heads lying around?

E-mail from another reader included the information that all of the pistons used in the 230 cid engine over the years were identical, thus the *only* way to increase compression is to shave the head. This sounds right, although the data came from an Internet site that had incorrect specs on the civilian engine. [Brief aside: personally, I prefer original, printed manuals. I've seen far too many biased opinions on the Internet being passed off as facts.]

Our M37 guru, Steve Turchet, chimes in with the following: "While I think it's great that there are some individuals in the world who are constantly striving for improvement or perfection, I would say that in the case of trying to wring every last ounce of power out of an M37 engine—basically a 70-year-old design—it's a nice hobby for some, but generally a waste of time and effort for the average M37 owner. While nobody died and made me God, I usually smile when someone tells me of a 'noticeable power increase' after making this or that modification to a piece of old machinery.

"I once worked for a boat rental place, and we had a fleet of Johnson 6 hp outboards. The carburetor rich-lean mixture adjustment was a plastic knob that stuck out through the front of the engine cover and was clearly marked as such. People would always fiddle with it, trying to get that last ounce of poop out of the motor, and the spark plugs would wet-foul from too rich a mixture, either stranding the boat out on the lake and/or causing us a lot of unnecessary maintenance work.

"We tried taking off the knobs, but people would still mess with the mixture by using their tackle-box pliers. Then we tried cutting the off the adjustment shaft so it wouldn't

stick out through the cover. No good: people would take off the cover and use their pliers. Finally, we cut the shaft, drilled it for a cotter pin, and put the plastic knobs back on, leaving them in plain sight outside the cover but connected to nothing. I can't count the times I saw folks get into the boats, start up the motors, and painstakingly 'adjust the carburetors until they were completely satisfied that the motor was running just right! If you *think* it works, maybe it does.

"As to the extreme case of the gentleman in Tennessee, I certainly admire his determination. But speaking as someone who has probably put more continuous miles on a stock M37 than most people alive (over 80,000 on one trip), I can't help but wonder how such a high-strung beast would hold up in the long run. It's sort of like strapping a brandy keg to a Greyhound instead of a St. Bernard and sending him out in the snow. A last factor to consider is that boring out most older-design engines can lead to overheating problems due to the thinness of the cylinder walls; hot-rod Ford flathead V-8's suffered from this a lot.

"Bottom line, if you absolutely want more *dependable* power from your M37, and you don't care about authenticity, install a bigger engine or make the swap to diesel. If 'stock appearance is important, then consider converting your truck to a Canadian model, which used the larger 265 Chrysler flathead 6. (I had a Canadian M43 ambulance, and the difference in power over the 230 truly was noticeable.)"

Potential Engine Oil Problems

George Burk also mentioned that he has seen damage in several M37 engines caused by dirty oil. He writes, "improved oil filtration may be *the* essential improvement. In the original design, oil flows through the bypass filter only at pressures above 45 psi. I am trying to noodle out a way to add full flow filtration to the engine. I think the solution is to plug the original vertical passage above the relief valve, drill the block below this valve to plumb in a filter, then plumb the filter discharge back into the oil gallery. Back siphonage, volume reduction in the flow rate due to long external lines, and space restrictions are all potential problems to this modification."

Steve Turchet replies: "This doesn't make sense to me. First, unless there has been some modification, oil flows through the filter at *any* pressure, not just over 45 pounds. (In fact, many 230's I've seen would be lucky to get 45 pounds of oil pressure even on a cold morning.) The inlet line of the bypass filter takes directly off an oil gallery (as does the oil pressure gauge sending unit), and pressure is the same throughout the gallery at all times. Again, unless this unit has been modified in some way, oil flows directly from the gallery through an oil line, circulates through the filter medium, and is returned (filtered) to the engine. In most systems like this, there is a restrictor in the filter *return* line somewhere to maintain pressure.

"A bypass filter, since it filters only a portion of the engine oil at any given time, can (and does) have a finer (and therefore, more effective) filter medium. On the other hand, a full-flow filter—since *all* of the engine oil passes through it at all times—must have a coarser medium or it would seriously restrict oil flow. Therefore, a full-flow filter cannot filter as finely as a bypass. Bottom line: if engine problems are being caused by dirty oil, service the air cleaner and change the oil more often."

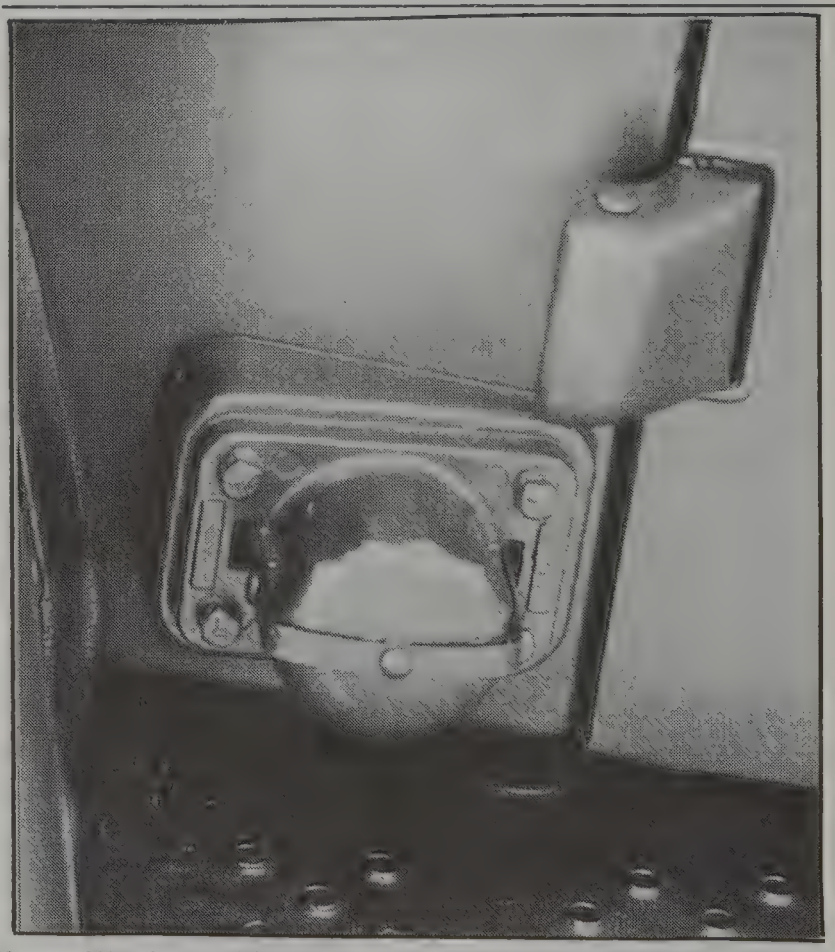
24V to 12V Conversion Revisited

Comments continue to arrive about running 12-volt accessories on a 24-volt system (see Q&A in Issues 61 & 62).

George Bonta of Hebron, KY, wrote to us suggesting the use of a 24-volt relay with the relay coil operated from the ignition switch and the contacts across the 12-volt battery take-off. This, he says, will prevent leakage in the add-on 12-volt accessories from discharging the battery supplying 12-volt power. Surplus outfits like All Electronics (818-904-0524) carry these relays for about $3, so it's a cheap precaution.

One reader suggested wiring power resistors in series with 12-volt accessories to step 24 volts down to 12 volts. He noted that high amperage power resistors cost between $10 and $30 and that in use they get *very hot*.

Frankly, although it's a very simple approach, I don't recommend using power resistors for several reasons. First, to figure out the correct resistance value, you must know the exact power draw of an item, which is not easy to determine—it's rarely printed on the case. Second, the power draw often changes during use; say you have a CB radio that normally draws 6 watts (0.5 amp at 12 volts which requires a 24 ohm stepdown resistor). Then you turn on the PA function which draws 24 watts (2 amps which requires a 6 ohm resistor). Whichever value resistor you chose to use would give you the wrong voltage half the time. Third, you're wasting a lot of battery power as heat through the power resistor and, as the reader noted, they get unbelievably hot posing the risk of fire or, minimally, blistered paint.



If your M37 does not have a slave receptacle (mine didn't), it is worth adding one. They are readily available on the surplus market. One heavy wire (the shorter one) goes to any convenient ground point and the longer wire goes to the positive battery terminal on the starter motor. You can trickle charge your batteries through the slave receptacle using an inexpensive 24vdc power supply or you can get/give a jump start from/to another early M-series vehicle if you have the proper two-pin cable.

Strippin' 'n' Shoppin'

by David Ahl

Having completed its duty for our church's vacation Bible camp, our M37 came home. Stripping off the yellow paint and prepping it for body work were the next steps.

John Headley of Domcar was ready to rev up his air compressor and have at it using a blasting media called "Black Beauty," which is a sharp-edged, fast-working blasting media made of iron slag. On the plus side, blasting with it is fast, thorough, and relatively cheap. On the other hand, you get black grit in every nook and cranny of the vehicle; also the grit creates a rough surface on the sheet metal.

For a second opinion, I talked to Hibernia Restorations (a high-end automotive restoration shop) and they, predicably, recommended dipping. This, unfortunately, called for disassembling the entire vehicle and transporting the parts to the nearest Redi-Strip facility 100 miles away in Allentown, PA, something that I was not up for. Short of dipping, they felt that chemical stripper was the best choice, with plastic media blasting in third place.

I called two media blasting services in this area, both of which used a DuPont plastic medium. It's gentler but takes longer than Black Beauty. Don at Right-Way also admitted that it was nearly impossible to get the OD base coat completely off with plastic media. Also, both media blasting services were backed up 4 to 6 weeks. So that was out.

So I figured, "what the heck, why don't I experiment with the procedures described in Jim Richardson's paint stripping article (Issue #63, page 42)?" I bought some Klean-Strip Aircraft Remover; donned a sweatshirt, gloves, respirator, and goggles (on an 85° day); and spread a thick coat of stripper on the rear fender. I was ready for a 15-minute wait, but the yellow paint started bubbling off almost immediately. It was easy to scrape it off to reveal—guess what?—a coat of red! Another application of stripper and I was down to OD. Another coat of stripper revealed yet another layer of OD. More stripper and I finally saw bare metal.

Three hours, a quart of stripper, and a gallon of sweat later, the rear fender was done. It didn't take much to figure out that this was going to be a long process and require a LOT of stripper.

> Jim Richardson conducted a test of paint removers, the results of which were reported in the July 1997 issue of *Classic Auto Restorer.* Top performer by far was Blue Lightning (mail order only, $26/gal+s/h from CA, order line 800-501-1562). In second place was Klean-Strip Aircraft Remover available in auto paint stores. Forget about Bill Hirsch and POR, at least for stripping products.

A few days later I was showing the M37 to some guys who work for Morris Township and mentioned the problem of stripping the paint. Lou Windt volunteered that the paint stripping sounded like getting paid for having some fun. I wasted no time in getting the M37 to Lou's backyard along with several gallons of stripper, scrapers, abrasive disks, respirator, and the whole nine yards. (If I were a bit more patient, I would have ordered Blue Lightning stripper by mail and saved some bucks because of its higher efficiency.)

Of course, I don't want the M37 to start rusting away once it's down to bare metal. Much as I'd have liked to use DuPont's two-step self-etching Variprime, I can't because it has to cure indoors. So I settled on Mar-Hyde self-etching primer. It's a single step primer that comes in a spray can and can be sprayed right on cleaned and prepped bare metal.

After a day of stripping and scraping, Lou found that the best way to get the stripper off was to blast the bubbled paint with a high pressure power washer. Faster and less labor-intensive. Lou told me that his plan was to strip, clean, prep, and spray self-etching primer on one part of the vehicle every day. Anticipated time to finish: 7 to 10 days.

Actual time? Who knows? Unusual for this time of year, New Jersey has had one of the longest stretches of rainy afternoons than I can remember. I kept thinking that this couldn't go on, and every day we had another shower.

Meanwhile, I had taken off many of the lights and other items and decided to try the Drano stripping method. Our local A&P didn't have any powdered drain cleaner (lye), so I figured that the liquid stuff would do the job, albeit somewhat slower. Wrong. It sort of took some of the yellow color out of the paint pigment, but then I was left with white painted parts. I left the parts in over night thinking that time was my friend. Wrong again. Where the paint was scratched, the liquid drain cleaner started pitting the metal. Bad news.

So I got some powdered lye drain cleaner (100% sodium hydroxide), put it in a large old pot of warm water, and dropped in the parts. The paint immediately started lifting right off. The paint was more tenacious on some parts than on others, but wire brushing them and throwing them back in did the trick. Small parts (nuts and bolts) I put in a sieve so I could easily get them out.

If you decide to use this method, be aware that the water will get opaque with paint particles and you won't be able to see the parts in the bottom. After I learned this the hard way, I started putting a piece of wire on each part so I could fish it out and dip it into a pot of rinse water. Also the wire made it easy to hold the parts for drying off with Betsy's hair dryer.

Once stripped down to bare metal, these parts received a coat of self-etching primer. The primer gives you a time window of 36 hours to spray on a finish coat without requiring sanding, so I also sprayed all of these parts with one coat of flat OD.

The other thing that I've been busy doing is scouring the swap meets and ads for needed parts. In the last two months that effort, along with about $600, has yielded an NOS tailgate, takeoff hood, bed canvas, blackout light and bracket, gas can and strap, spark plug cables, bed bow corners, two (out of three) pioneer tools (no rack yet), bridge weight plate, winch plate, shackles, glove box door, tailpipe extension, right headlight guard, and window slider inserts.

Sweating the Details: Fasteners, Rust, and Paint

by David H. Ahl

As we reported last issue, stripping the paint from our M37 was taking much longer than expected due to some uncooperative New Jersey weather. Finally, on September 22 Lou Windt announced that he was done and that the M37 was stripped and primed.

Unfortunately, the rubbery undercoating in the wheelwells and on the undercarriage was remarkably resistant to both Klean Strip and Blue Lightning, so that is something that will have to be faced later. Also, the stripper had gotten beneath the masking tape I had put over the dash gauges, so now I have five cloudy, mottled gauge covers. Another problem to be faced later.

But first, with the vehicle having only a coat of MarHyde self-etching primer, it was necessary to make space for it in our garage. That meant finding a new home for the Sunfish and trailer, leaf blower, lawn mower, seed spreader, snow blower, garden cart, a huge bundle of 1000 shipping cartons, and a few hundred other assorted items. It also meant disassembling the top of the M37, which was 2" too high for the garage door.

That, of course, led to other discoveries. As I had found out earlier when taking off the bed uprights, the previous owner (Deer Park Fire Dept. in Wisconsin) frequently substituted nuts and bolts for the military ones with little regard for size, threading, or hardness.

Nuts and Bolts

Hex-head bolts are made in 12 grades of hardness from SAE Grade 0 steel to ASTM-A 490 quenched and tempered alloy steel. But in reality, only three grades are commonly available: SAE Grades 2, 5, and 8, each of which has its pros and cons. Grade 2 bolts are made of soft low-carbon steel and have low tensile strength (64-74,000 psi); they usually have a bright finish and have no radial lines on the head. Grade 5 bolts have medium tensile strength (105-120,000 psi) and have three radial lines on the head. Grade 8 bolts have the highest tensile strength (150,000 psi) and have 6 radial lines on the head.

A Grade 8 bolt will snap if it is forced to bend but has very high resistance to stretching and will withstand an extreme amount of torque. In contrast, a Grade 2 bolt will stretch, twist, and bend before breaking. Grade 5 falls between the two and is the type most often used on military vehicles.

Type 2

Type 5

Type 8

Bolts are made with two basic types of threads, National Coarse (NC or just coarse) and National Fine (NF or just fine). Coarse bolts have fewer threads per inch but also have deeper grooves, which reduces the chance of stripped threads or pulling the threads of the nut or mating surface. Cylinder-head bolts, for example, are coarse. Fine bolts have more threads per inch but have shallower grooves. A fine-thread bolt has more contact area and will deliver greater clamp strength with less torque.

Larger bolts on military vehicles generally have a fine thread. You can expect to find 10-32, 1/4-28, 5/16-24, 3/8-24, 1/2-20 bolts in various lengths. About the only coarse thread screws used on military trucks are 8-32 screws on instrument panels, lights, and radios, 10-24 screws on door handles, and 12-24 screws on door inspection panels.

Bolts are made of many materials: aluminum, brass, steel, stainless steel, silicon bronze, even nylon. Steel bolts are often plated with a variety of materials: zinc, zinc chromate, cadmium, nickel, and phosphate. Cadmium is a non-porous metallic coating with a dull finish commonly used on aircraft. It's my personal preference, but it's not widely available, so I usually wind up with zinc. Unplated steel bolts or ones with the plating worn or scraped off are very susceptible to rust and should be replaced if possible.

The vast majority of fasteners sold today are Grade 2 hardness with NC threads. Indeed, the firemen owners of my M37 replaced a fair number of 5/16"-24 (fine thread) Grade 5 bolts with 1/4"-20 (coarse) Grade 2 bolts. This kind of substitution is completely unsuitable and I had to hacksaw off or drill out most of these bolts because they were too bent or rusty to unscrew.

For your military vehicle, the ideal replacement bolts are cadmium, zinc, or phosphate-plated Grade 5 hardness with the same threading (usually fine) as the originals. I know several people who swear by stainless steel (no rust or corrosion) and it's probably fine for most applications, but stainless has only three quarters the strength (90,000 psi) of a Grade 5 bolt. Also, you can expect to pay about four times as much for stainless as for Grade 5.

Incidentally, there are many counterfeit fasteners on the market. Just because a bolt has three or six lines on the head doesn't make it a genuine Grade 5 or 8. Be especially cautious when buying imported or swap meet fasteners. Also, with an unmarked head, you never know what you're getting; it could be Grade 2, Grade 1 or even Grade 0.

Home Depot wasn't much help on the bolts I needed, but our local Ace Hardware had a good stock of the correct replacements. Also, large hardware jobbers such as Grainger, McMaster-Carr, and Service Supply, have virtually everything

available locally or by mail.

On an M37, the fasteners most difficult to find are the 5/16-24 x 7/8" flat Phillips-head screws used on the bed. You would be forgiven for using 5/16-18 screws, which are more readily available, although Service Supply does stock the fine-thread ones.

In case you have to tap threads or drill holes in a new part, the table of drill sizes should be helpful. Incidentally, if you don't have a set of wire gauge number drills, you might want to consider getting one. Or if you just want a short set of the most needed sizes, go to a large hardware jobber like Grainger and get one or two each of these ten drills: #43, 36, 31, 29, 25, 21, 7, 3, I, and Q.

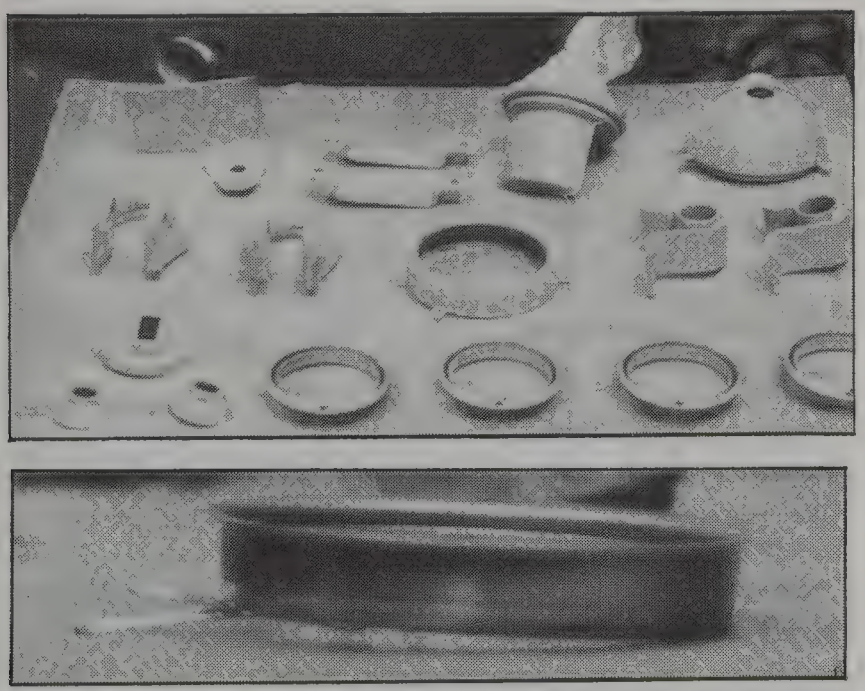
With a source of replacement nuts and bolts lined up, it was time to take off all the bits and pieces that I hadn't previously removed and deal with refurbishing, repainting, or replacing them.

Fanatic About Rust

As I mentioned in a previous article, I'm not a fanatic about restoring my M37 to look like the day it came out of the factory; I'm willing to fasten the data plates on with self-tapping screws rather than rivets, use modern weather stripping, repair the steering wheel with epoxy filler, and even install power steering and power brakes.

On the other hand, I am an absolute fanatic about rust. Unfortunately, after working so many afternoons on stripping the paint with no cooperation from the weather, Lou got to that point that we all tend to reach on projects that never seem to end where he said to himself, "Okay, I've had it. The truck is done." Even though it wasn't. Yes, the main body panels and interior had all been stripped and primed, but old paint tenaciously hung on in lots of awkward places. Worse, on a number of bent and dented parts, I noticed rust poking its head through the primer as it continued its relentless dance of destruction on the metal beneath.

To get the M37 into my garage, I had to remove the window top and side rails. Okay, I admit it, I should have done this sooner. Every one of these pieces had gobs of old paint and spots of rust. Ditto the bed rail uprights, ditto the headlights and taillights, ditto the windshield frame, ditto all of the brackets, and so on. Dealing with this mound of parts plus the dash panel required nearly two more gallons of stripper. I used Blue Lightning (mail order) and Captain Lee's Spra-Strip (swap meets), both of which performed very well.



Top: small parts get a coat of self-etching primer. Bottom: propping a part on bent paper clip helps pevent the paint from sticking to the cardboard. Hanging parts on wires for spraying is another approach.

To get the paint off these small parts, you can't just blast off the stripper with a high pressure washer as Lou did on the large body panels. Instead, I needed #0 steel wool, sandpaper, Scotch Brite pads, small wire brushes (like tooth brushes), along with wire wheels, a rotary paint stripper, and sanding disks for my electric drill. Don't spend big bucks for this stuff; you're just going to toss out most of the items after they're caked with used stripper and gummy paint. I got a bunch of cheap wire brushes (five assorted for $3), some blister packs of six wire wheels ($5) and a 12-pack of Scotch Brite pads at our local Job Lot outlet.

In most cases, the wire wheels got the rust off, but on some parts such as the tailgate support and rear light brackets on which the metal was more deeply pitted, I had to use a chemical rust remover. In the past I've generally used the jelly-type remover (naval jelly, Rust Biox, etc.), but I decided to try a faster-acting (and harsher) liquid from Blue Lightning. You just spray or sponge it on and the rust practically dissolves as you watch; it's quite amazing.

As soon as I was down to bare metal on any part, I wiped it with metal prep, a combined mild acid etch and rust preventative, again from Blue Lightning. This buys you some time; as long as the parts are kept in a dry place (I put them in my furnace room), they need not be immediately primed and painted.

Eating My Words

Even after all this work, some of the parts still had rust in awkward spots that I couldn't reach with a wire brush. Some still had blotches of OD paint or primer clinging tenaciously and some parts I just hadn't dealt with yet. Moreover, until now I had completely ignored the bed floor with its ragged holes, messy patches, and major league rust. I mentioned this bed problem to George Simione at Tobyhanna, and he offered to send me a 1' x 2' hunk of bed floor from a parts M37. He had lightly sandblasted it to take off the loose scale and recommended that as an approach for the entire bed floor. George works in a UPS body shop where sandblasting is used far more commonly than strippers or chemicals.

Maybe it was time to rethink sandblasting. You'll that recall in the last issue I said I talked to Hibernia Auto Restoration and they opposed sandblasting because it damages the metal. Prompted by a note from John Headley of Doncar Equipment, I pursued the subject further with that shop as well as three other resto experts (something I should have done sooner). The bottom line is that sandblasting (or blasting with a high abrasive media such as Black Beauty) has pros and cons. The main downside seems to be that it can cause heat buildup which in turn can cause warping in thin, unsupported body panels (as you might find on a late-model passenger car). Second, in rusty areas, it can potentially take off some good metal along with the rust. Third, it can leave a slightly rough finish on body panels which is not suitable for a concours quality high-gloss lacquer paint job. And last, if you're not doing a frame-off restoration, the blasting media gets into every nook and cranny of the vehicle.

The pros are that sandblasting is fast; it is relatively cheap;

it removes rust thoroughly; and it is much less labor intensive than other stripping methods.

Furthermore—and this is where I was dead wrong last issue—most of the cons don't apply to sandblasting of military vehicles. You just don't have a lot of thin, unsupported body panels, so warping isn't a problem. You're not going to be painting the vehicle with high-gloss, mirror finish lacquer, so a slight surface roughness doesn't matter—in fact blasting provides a very good surface for paint adherence, much like lightly sanding your primer coat—and the final paint coat is absolutely smooth in appearance and feel.

I sort of feel like I'm going around the circle the wrong way: start with chemical stripper, do some dipping, next some scraping and wire brushing, and now, for the bed and undercarriage, finish up with sandblasting. I owe an apology to John Headley for my remarks last issue, and I hope when I drive the M37 into Doncar's shop—it's next stop—John doesn't aim his sandblasting wand at me.

Glass Replacement

Since I had disassembled the windshield, this was as good a time as any to replace the broken glass in the passenger-side window and driver-side windshield. Removing the glass from the door window was simply a matter of removing four screws, taking off the top of the frame, and carefully pulling out the glass. The windshield looked a little hairier and, after talking to several other people who had dealt with a broken windshield, I elected to take the entire assembly to an auto glass shop.

Talk about sticker shock! Two days later the shop called back with a quote: $40 for the side window glass alone and $75 to replace the windshield. I probably should have shopped around, but I was up to my eyeballs in work, so I told them to go ahead. A reasonable price on a piece of side glass ought to be under $30, while a windshield replacement with rubber gasket should be no more than $50 or $60.

As for the M37 itself, it was time to do something about covering up the gray primer, which meant body work and paint. The series of articles by Jim Richardson covers body work rather thoroughly, so I'll skip that here. Paint is another matter.

		Tap drill		Body drill		Body drill	
Thread		(75% thread)		Snug fit		Loose fit	
Nominal size	Pitch series	Drill size	Fraction size	Drill size	Fraction size	Drill size	Fraction size
4-40	NC	43	3/32	32	ns	31	1/8
4-48	NF	42	3/32	32	ns	31	1/8
5-40	NC	38	ns	30	ns	9/64	9/64
5-44	NF	37	ns	30	ns	9/64	9/64
6-32	NC	36	7/64	27	ns	23	5/32
6-40	NF	33	ns	27	ns	23	5/32
8-32	NC	29	9/64	18	11/64	15	3/16
8-36	NF	29	9/64	18	11/64	15	3/16
10-24	NC	25	5/32	9	ns	5	13/64
10-32	NF	21	5/32	9	ns	5	13/64
12-24	NC	16	11/64	2	ns	1	15/64
12-28	NF	14	3/16	2	ns	1	15/64
1/4-20	NC	7	13/64	1/4	1/4	17/64	17/64
1/4-28	NF	3	7/32	1/4	1/4	17/64	17/64
5/16-18	NC	F	17/64	5/16	5/16	21/64	21/64
5/16-24	NF	I	17/64	5/16	5/16	21/64	21/64
3/8-16	NC	5/16	5/16	3/8	3/8	25/64	25/64
3/8-24	NF	Q	21/64	3/8	3/8	25/64	25/64
7/16-14	NC	U	3/8	7/16	7/16	29/64	29/64
7/16-20	NF	25/64	25/64	7/16	7/16	29/64	29/64
1/2-13	NC	27/64	27/64	1/2	1/2	33/64	33/64
1/2-20	NF	29/64	29/64	1/2	1/2	33/64	33/64
9/16-12	NC	31/64	31/64	9/16	9/16	37/64	37/64
9/16-18	NF	33/64	33/64	9/16	9/16	37/64	37/64
5/8-11	NC	17/32	17/32	5/8	5/8	41/64	41/64
5/8-18	NF	37/64	37/64	5/8	5/8	41/64	41/64
3/4-10	NC	21/32	21/32	3/4	3/4	49/64	49/64
3/4-16	NF	11/16	11/16	3/4	3/4	49/64	49/64

Paint Your Wagon

M-series vehicles were produced from the early 50's on; some are even being remanufactured today. For most M-series vehicles, the Army switched from the flat (or lusterless) olive drab paint of WWII to a darker, browner semi-gloss O.D. color. The Federal color number for this paint is 24087; a flat version of the same color is 34087. In the Federal numbering system, the first digit defines the appearance (1 = gloss, 2 = semi-gloss, 3 = flat).

I talked to Bob Foster of The Right Stuff about paint and he gave me much good information. For example, military paint has a very high milled-pigment content—up to two pounds of pigment per gallon. As a result, military paints cannot be accurately duplicated by the color-match system at your local automotive paint store. Yes, they can come very close to matching the color, but the resulting paint will have a much lower pigment content. Incidentally, the high pigment content of military paint makes it vital to keep it well stirred during the application process.

Today's automotive paints are much higher quality than those used in the 40's and 50's and even though the pigment content is lower, they should stand up well in normal use. The commercial equivalents for semi-gloss 24087 O.D.-brown are Ditzler DQE-42955 enamel or DAL-42955 lacquer, DuPont 93-29149 enamel or 246-29149 lacquer, Rinshed Mason 2U-3742 enamel, and Acme 22-1744 enamel.

[Brief aside. The O.D. color on the cover of Issue #63 was actually a mix of two ink colors, yellow and black. If cost is vital to you but color accuracy is not, you can get a pretty good WWII O.D. by mixing paint 16 parts yellow to 4 parts

black. For a darker shade, add 1/2 part red to the mix. For a lighter shade, try 16 parts yellow, 2 parts black, and 1/4 part red. Instead of the red, put in 1 part green for a greener O.D. or 1 part blue for a darker color. The color that is closest to 24087 is gotten by mixing 15 parts yellow, 4 parts black, and 2 parts blue. It's fairly close, but not exact. Be sure to try any of these colors on a piece of scrap first!]

Very few manufacturers make paint in accordance with the Federal Standard 595A for sale in the civilian market. Some paints match the colors of FS 595A, but because they are not made with the same manufacturing process or ingredients they fade and oxidize fairly quickly, giving the vehicle a dishwater gray cast, especially if it is not garaged.

Another problem with some paints is the use of a liquid flattening agent rather than a ground solid as used in true military paint. Liquid flatteners tend to dissipate unevenly during application resulting in painted areas that are flat and others that look almost semi-gloss.

My advice if you're going with 24087 semi-gloss is to either use one of the modern automotive equivalents listed above or look for a paint that is actually manufactured in accordance with FS 595A.

Most M-series vehicles were still in use when the first camouflage standards were mandated in 1976 (Technical Bulletin 43-0209). This standard defined a four-color camo scheme in seven variations depending upon geographic area. In 1990, TB 43-0209 was revised to define a three-color camo scheme. The colors used in the two camo schemes are shown in the table.

Since my M37B1 is a late one, I plan to paint it as it would have been in my unit (18th Airborne Corps at Ft. Bragg). Since the unit is a STRAC (Strategic Army Corps) unit, its vehicles were painted in camo as soon as the standard came out. So I'm going with a four-color U.S. summer camo scheme of forest green, light green, sand, and black. I've seen four or five M37s painted in three-color camo; this is totally incorrect as there were no M37s still in active service in 1990, but if you like the way it looks, that's what really counts.

Thanks for Your Help

I might mention that several readers have offered advice on the M37; thank you! My special thanks to Mark Yocum of St. Charles, MO, who went beyond mere advice and sent me a box of bed screws (course thread) plus a taillight bracket to replace my mangled one. Also to Pat McDermatt of Danbury, CT, who sent a piece of reinforced rubber of the type that goes between the frame and the cab. We'll let you know about this installation later on.

Colors for 4-color camouflage system (1976-1989)

		U.S./Europe		Tropics
		Summer	Winter	All
Forest Green	34079	45%	45%	45%
Light Green	34558/341514	5%		5%
Field Drab	30118		45%	
Dark Green	34102			45%
Sand	30277	5%	5%	
Black	37038	5%	5%	5%

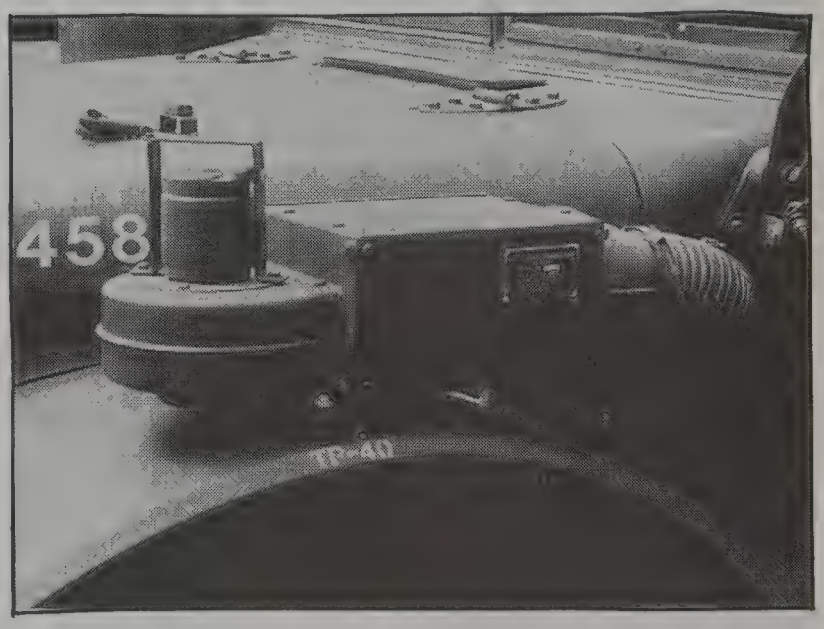
Colors for 3-color camouflage system (1990 on)

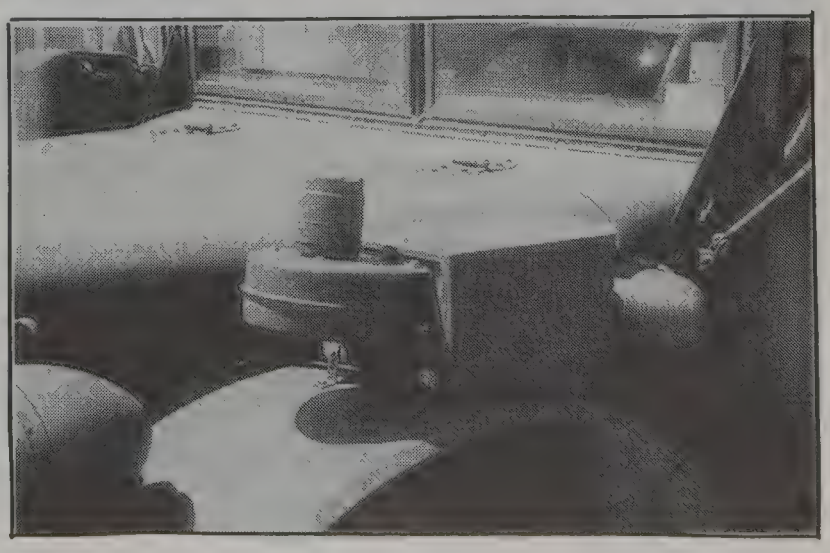
		Most geographic areas
Green 383	34094	44%
Brown 383	30051	15%
Black	37030	41%
Field Drab	33105	acceptable to replace black*
Sand	33303	acceptable to replace brown*

* discretion of local commander in certain geographic areas.

Sources:

Nuts & bolts, tools, drills, etc.: Grainger (350 branches in 50 states). For branch locations, check phonebook or write 333 Knightsbridge Pwy., Lincolnshire, IL 60069. Internet catalog: www.grainger.com.
Nuts & bolts: Service Supply, 1311 Sadlier Circle, Bldg K, Indianapolis, IN 46239, 317-638-2424.
Stripper, rust remover, metal prep, etc.: Blue Lightning, 2094 W. Redlands Bl. K-107, Redlands, CA 92373, (800) 501-1562.
Paint: Bob Foster, The Right Stuff, 11 Collins St., Amesbury, MA 01913, (978) 388-1733; Western Resources, P.O. Box 48, Spencer, IN 47460, (812) 876-2171; Many others: see ads in magazine.





To the right are two slightly different gasoline-fired South Wind heaters to provide heat to the cab. Both are designed for extreme cold conditions and are frequently installed along with an auxiliary gasoline-fired engine and battery heating system. The cab heater provides an enormous amount of heat and is especially effective on the feet where it is most needed. On the other hand, there are only two settings: very hot and extremely hot, so for more temperate climates it is overkill.

Sandblasting: The Ultimate Solution

by David H. Ahl

It's been two issues since we reported any progress on restoring our M37 project vehicle. As I mentioned in the last issue, my 86-year-old mother in Florida fell and broke her hip so Betsy and I have made three trips down there to move her from her house to an apartment in a senior living community. All told, that took about three weeks, some of which I would otherwise have spent on the M37.

We left off in Issue #65 with the four coats of old paint largely having been stripped off the exterior body panels and the vehicle exterior sporting a coat of gray Mar-Hyde self-etching primer. But the undercarriage still had a heavy coat of a rubbery tar-like substance with a spotty film of dirty yellow paint. Also, the dash, lights, brackets, and nearly every nook and cranny still had from one to four layers of old paint, now disguised with a coat of primer. From arm's length, the vehicle looked wonderful, but as you got closer the irregularities became quite apparent.

So I decided I had no choice but to take off pretty much every exterior item: headlights, stop lights, blackout lights, tie downs, pintle hook, winch, front and rear bumpers, windshield, window rails, doors, hood, radiator cowl, engine side panels, etc. Each group of larger parts went into its own cardboard carton with the corresponding nuts and bolts going into a zippered plastic bag. In each bag, I also put a slip of paper identifying the parts and noting any assembly idiosyncrasies.

I could have gone right down to the frame, but I wanted to be able to drive the vehicle in and out of my garage while working on it and later to John Headley's Doncar facility in Flanders for sandblasting and from there to Carl's Body Shop in Morristown for painting.

Needless to say, driving with no windshield, lights, or mirror is not something I recommend—that's apart from it being highly illegal—but none of my friends had a trailer and tow vehicle capable of handling the four-ton M37.

But I'm getting ahead of myself. With the front body bits off, I could get at the radiator to straighten the cooling fins. Apparently, the front of the vehicle had gotten whacked several times with tree limbs and who-knows-what, so the radiator fins were practically flat. Eastwood sells British-made pliers specially designed for straightening cooling fins, but I found that a putty knife and a lot of patience were quite satisfactory for the job. Appearance is just one reason to straighten your cooling fins; more important is cooling efficiency, which can go way down if your vehicle has a large flattened area as mine did.

All the smaller parts that I took off—lights, brackets, etc.—I dumped into that paint stripping witch's brew of lye (crystal Drano) and hot water that Jim Richardson talked about back in Issue #63. I put the nuts and bolts in a cheap kitchen strainer so I wouldn't have trouble retrieving them from the pot of opaque lye.

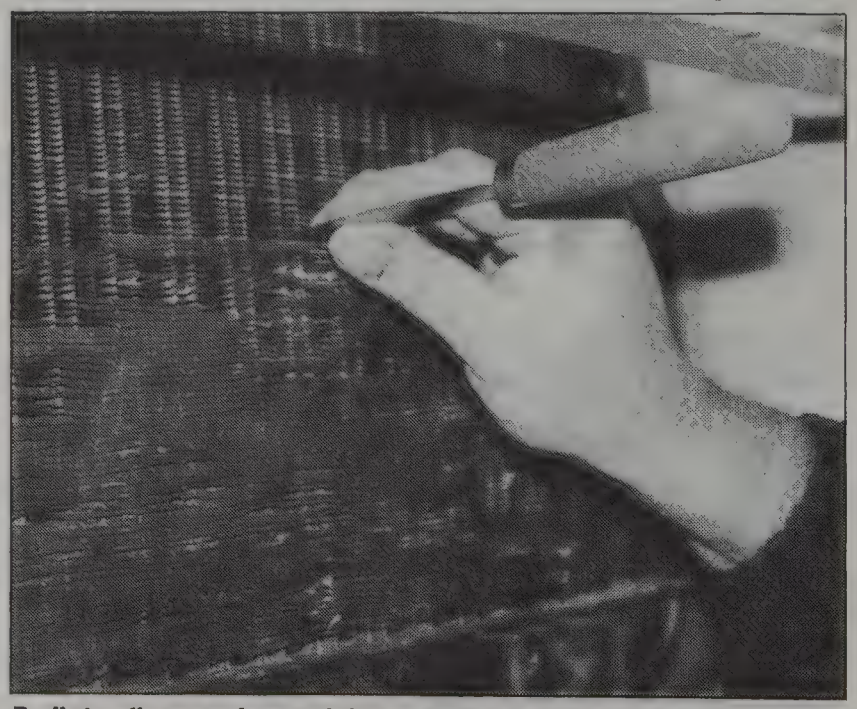
To get the paint off the larger parts, I used several methods: chemical stripper, wire brushes, sandpaper, and sandblasting in John Headley's cabinet.

Once the various parts were free of paint, I put on a coat of metal prep, which is a combination of mild acid (etches the metal for good paint adhesion) and rust preventative. Over that, I sprayed a coat of standard automotive primer. The parts that were sandblasted at Doncar were effectively etched by the Black Beauty blasting medium, so just a coat of primer with a rust preventative was satisfactory.

The heavy ¼"-thick tar-like undercoating was quite a challenge to remove. Had it been uniform, I probably would have left it alone, but it was not uniformly applied and was flaking off in spots. I won't bore you with all of the removal approaches I tried; let's cut right to the solution: a Fein triangle sander with a scraping blade. The sander head oscillates up to 20,000 times per minute and using the rigid scraper blade (not the flexible one) I was able to cut right into the undercoating and peel it off. Nevertheless, a great deal of the undercoating still required sandblasting to remove.

Although it is more expensive than other triangle sanders, I decided upon the Fein unit mainly for its wide range of attachments, which include a saw blade, a nifty sanding finger for narrow places, non-woven abrasive pads for paint removal, and the two scraper blades (rigid and flexible). Although I bought it for woodworking, I've used it far more on the M37 than anything else.

Speaking of buying things, I've also begun to purchase a wide range of parts and accessories for the M37 including gas can, tailgate chains, weatherstripping, bed canvas, pioneer tools and rack, radio antenna and mount, convoy light pole, bed bows, rifle-mounting kit, demilled M1 carbine (this is New Jersey, you know), M16 training rifle, and more. In all, I've more than doubled the initial $3,250 vehicle cost and ahead will be more expenses for sandblasting and painting.

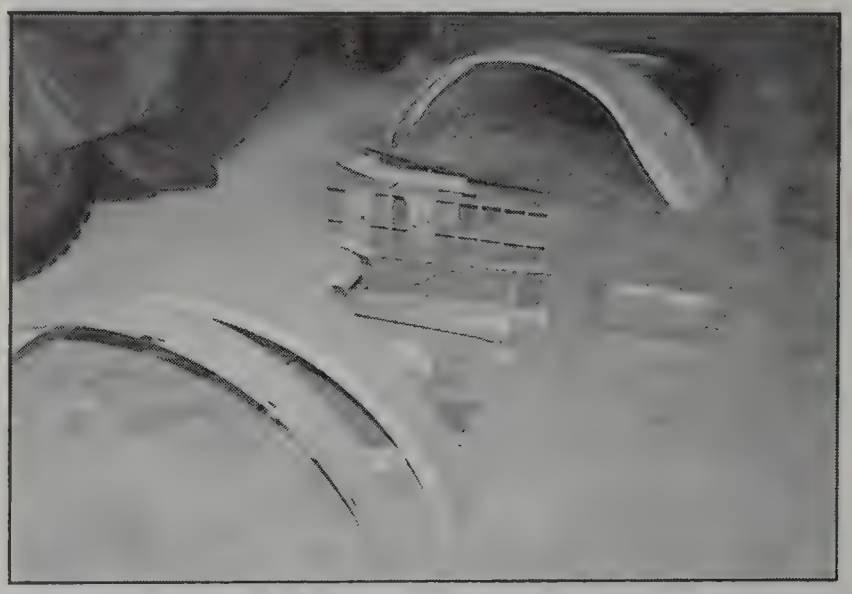


Radiator fins can be straightened with a putty knife and patience.

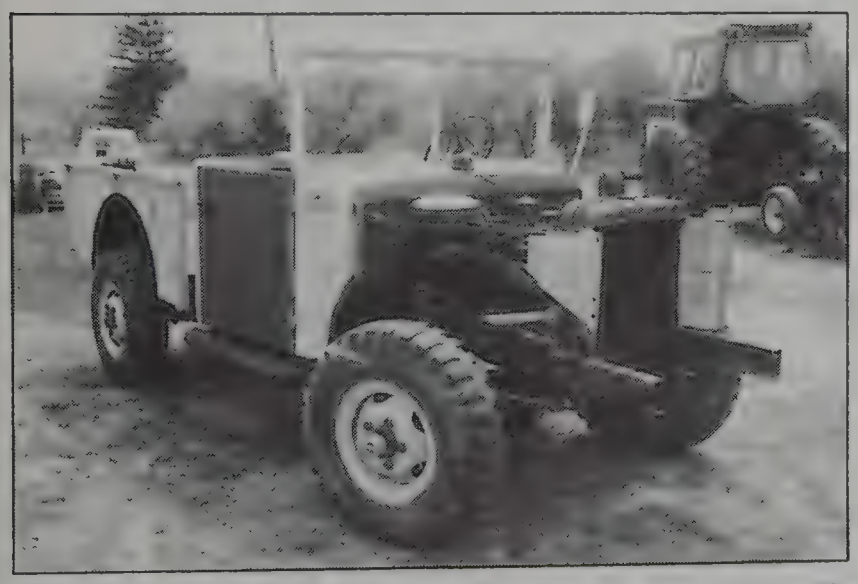
To remove the pintle hook required some ingenuity, a crow bar, and large pipe wrench.

The Fein triangle sander and rigid scraper blade is an excellent tool for removing thick tar-like undercoating.

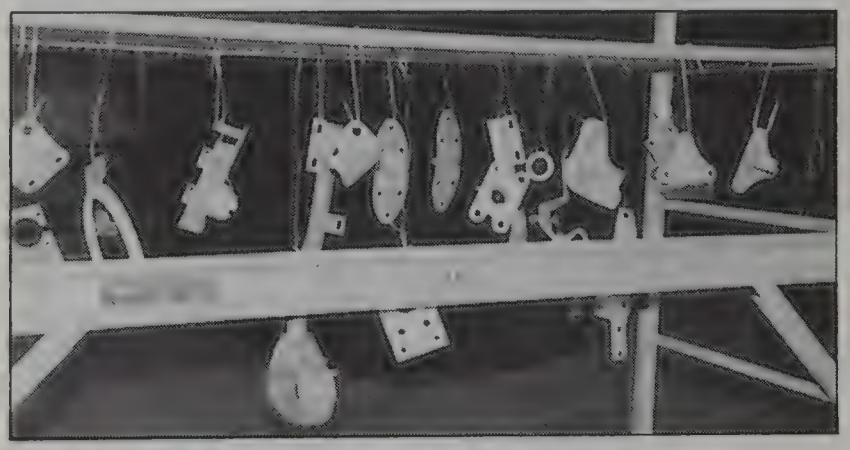
Area around the winch and winch bumper supports vividly illustrates the problems of removing rust, undercoating, and four coats of paint.



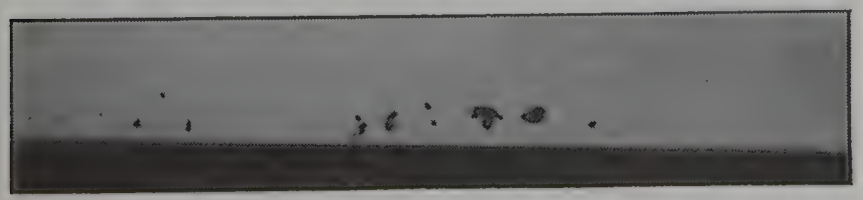
Fenders, grill, and larger parts sandblasted and primed.



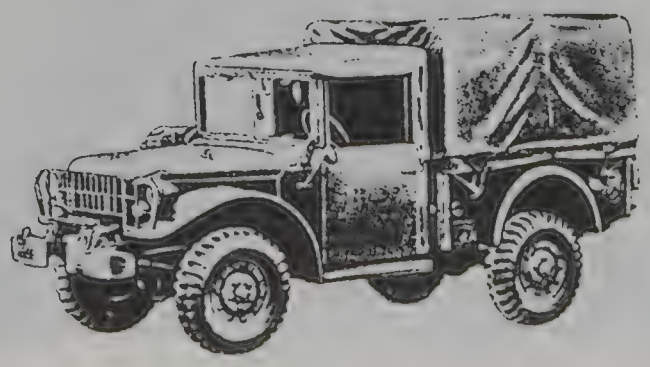
Here's the M37 after driving from Morristown to Flanders. The windshield frame is just for show; there's no glass in it.



Parts after sandblasting waiting for a coat of primer.



Sandblasting revealed many small rust holes in the side of the hood.



Preparing For Paint

by David H. Ahl

One of the concepts that makes the Airborne so effective is known as LGOP. Pronounced *el-gop,* the acronym stands for "Little Groups of Paratroopers." If a chalk gets shot up or split up in a drop, the troopers who land okay immediately form up in LGOPs, each one of which pushes on toward the overall objective. Now LGOPs may not be as efficient as a massed battalion of tanks, but they're effective and they get the job done.

Similarly, in restoring a military vehicle, you can use a broad, frontal assault or you can deal with one, small piece at a time. In the broad approach, you disassemble the entire vehicle, perhaps down to the frame, and then you do all your paint stripping, all your bodywork, all your parts fabricating and rebuilding, all your painting, and finally your reassembly. Bear in mind that a disassembled vehicle takes a *minimum* of three times the space occupied by an assembled vehicle and during the painting stage it can take as much as five or six times the space.

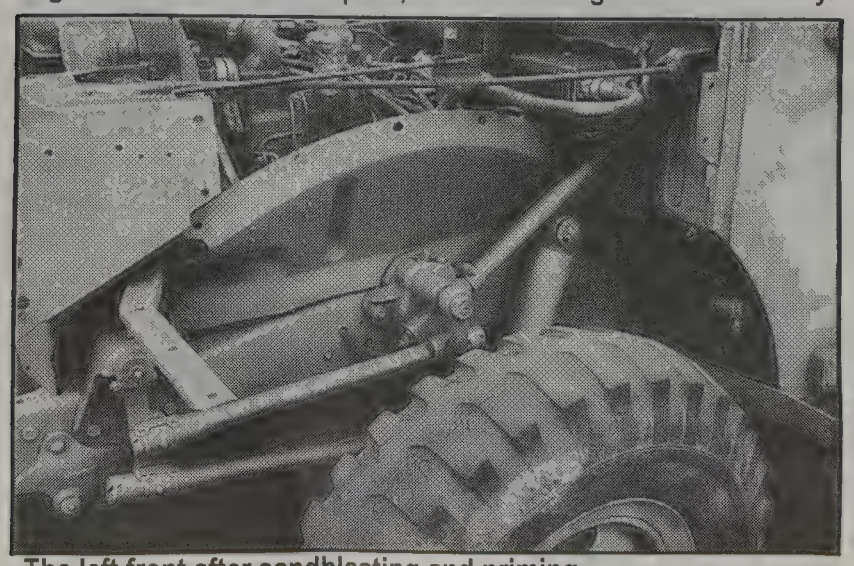
In addition to needing more room, another downside of the broad approach is that there are many points along the way where the job looks so overwhelming that you're tempted to throw up your hands and quit. Although you may think, "well, this would never happen to me; I'd never quit," remember that every issue of the ***Military Vehicles*** carries classified ads for complete vehicles in pieces. These are undoubtedly placed by people who were equally confident of finishing when they took out that first bolt.

In contrast, in the piece-at-a-time approach, you take off one assembly, say the bumper, a fender, or the dashboard, and deal with it completely—stripping, bodywork, rebuilding, painting, and reassembly. It's not very efficient compared with the total vehicle approach, but during most of the process your vehicle is still driveable, it takes a lot less garage space, and if a crisis crops up in another part of your life, you're not stuck with a zillion assorted vehicle parts spread all over your garage and basement.

Beware: you can get sucked into the broad, total vehicle approach without ever intending to. That, in fact, is what happened to me. On the rear of my M37, for example, I took off the composite lights intending to refurbish them. But then I saw that the mounting brackets needed attention too, so I took them off. That then revealed problems with the bumpers, so they also had to come off. The same thing happened with the winch, the front lights, the windshield, the doors, and on and on. Eventually, except for the cab and bed, I was right down to the frame.

First, I put the parts that I took off in the basement. Then the furnace room. Then I moved my other truck outside and filled the garage with parts. Conservatively, the truck and its pieces are now occupying four times the space of the assembled vehicle. And it's getting worse as I try to spread them out for priming and painting.

I tried to get off the paint and undercoat with an attachment for a Fein triangle sander. It worked to a point, but sandblasting was still necessary.



The left front after sandblasting and priming

Getting Ready to Paint

If you've been following along with us, you know that our M37 project vehicle had been stripped of paint with a combination of chemical stripper and sandblasting. This was followed by acid etching and several coats of automotive acrylic enamel primer-sealer.

I guess I ought to mention that I don't consider myself much of a spray painter. Anything that I've ever painted has had drips, sags, and thin spots. As a result, I started asking questions of anybody and everybody who had experience painting—experts, amateurs, paint manufacturers, and body/restoration shops. Here are some things I found out about painting a military vehicle. These are things *over and above* the general painting principles described in Jim Richardson's series of articles (which I strongly recommend you read before undertaking a restoration of any kind).

First of all, primers and flat paints do not provide a good moisture barrier. In a gloss finish, the paint molecules bond tightly with each other with no spaces between them so that moisture cannot get through. Even a very thin coating of gloss paint will keep moisture—and everything else—out. Think of it as a piece of plastic wrap; it doesn't matter whether it's a

half-mil thick or a half-inch thick, moisture can't get through.

In contrast to a high gloss paint, flat (or lusterless) paint is designed to not reflect light. It does this by having a rough finish that bounces light rays in every direction. Look at flat paint under a 50-power lens and it looks like rough desert terrain. This roughness is caused by tiny solid particles of pigment that don't join together smoothly. As a result, water can fill in the crevices between the pigment particles and work its way down to the metal. Think of flat paint as sand in a sandbox; no matter how tightly it's packed, if you pour water on it, eventually it will work its way to the bottom. In addition, flat paint absorbs other liquids as well and shows stains from things like oil, bird droppings, crab apples, and Popsicles more than a gloss finish.

What all this means is that to provide an effective moisture barrier you need many more coats of primer and flat paint than of a gloss enamel. Moisture protection of flat paint goes up *exponentially* with thickness in other words, double the thickness of paint, say 4 mils compared with 2 mils, gives you four times the protection. In practical terms, this means you should have *at least* five or six coats of paint; three of primer and two or three of the color coat.

The cheap way to make flat paint is to load it up with solids (pigment); that's the kind of paint the Army buys. Because of the high content of solids, when you apply military paint, you have to mix it practically continually while shooting it on. One painter told me that he puts a few ball bearings in his spray gun to help keep the paint agitated.

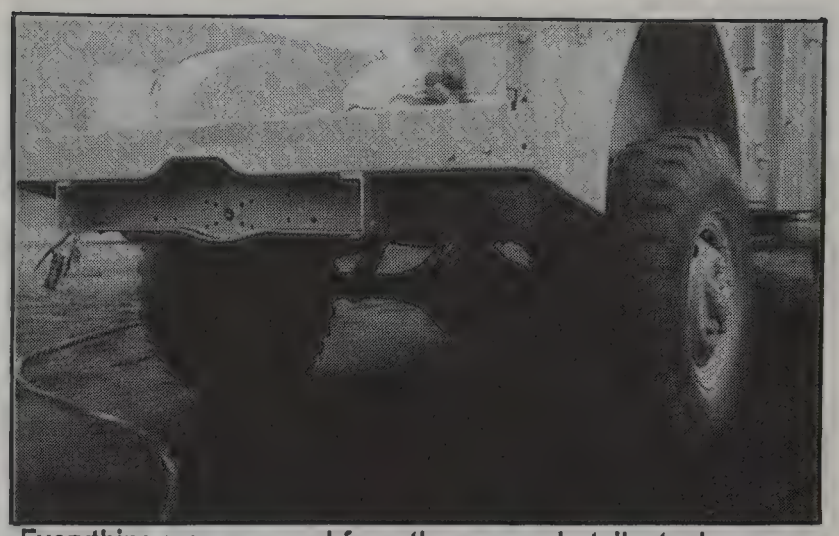
Some after-market manufacturers of flat paint use a flattening agent in their paint called *fume silica.* This allows them to use somewhat less pigment and produce a paint with modestly better moisture protection than one flattened with solid pigment alone. It still doesn't have anything like the protection of a gloss paint.

Different paints react differently with sunlight, especially the ultraviolet (UV) rays. Flat paint is especially sensitive to UV, and you'll notice flat painted vehicles showing more of a white haze sooner than vehicles painted with a gloss or semi-gloss finish.

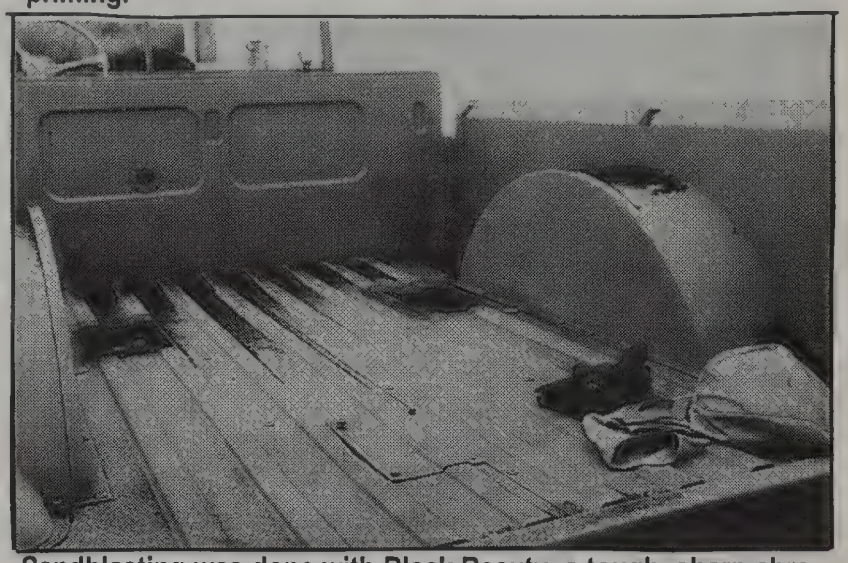
If you buy a gallon of automotive paint, say DuPont or PPG, the manufacturers are adamant that you use only thinners and hardeners meant for that brand. They furnish a data sheet—or sometimes a booklet—describing exactly the ratios for different temperature and humidity conditions. This is good advice; the products have been thoroughly tested together and are known to work correctly.

In contrast, military paint manufacturers tend to be much more casual in their mixing advice. A spokesman at Gillespie Coatings, for example, told me that their enamel could be thinned with VM&P Naptha, Xylene, or Toluene. "Use between 10% and 20%, whatever works best with your spray nozzle," I was told. Temperature and humidity didn't enter into the equation. Incidentally, these thinners aren't used with any modern automotive paints; look for them at Home Depot or a house paint store, not at an automotive paint supplier.

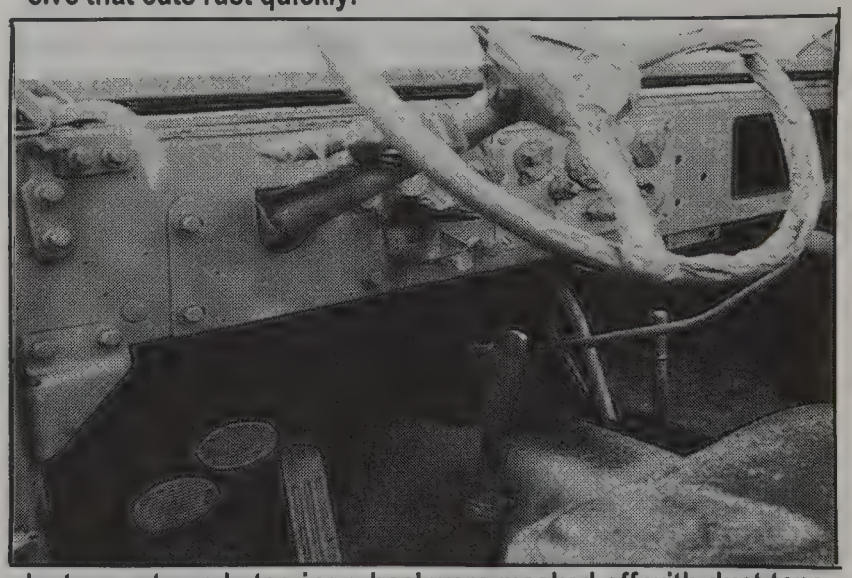
"What about a hardener," I asked. "You can use one if you want to speed up the two-week fully hard drying time to a day or so. But," said Dr. Charles Kaplan, president of Gillespie, "use a hardener made for synthetic enamel, not acrylic, and use only one-half the normal concentration because the resins in the hardener will cause a flat paint to dry



Everything was removed from the rear end—tailgate, bumpers, pintle hook, lights, and brackets—prior to paint removal and priming.



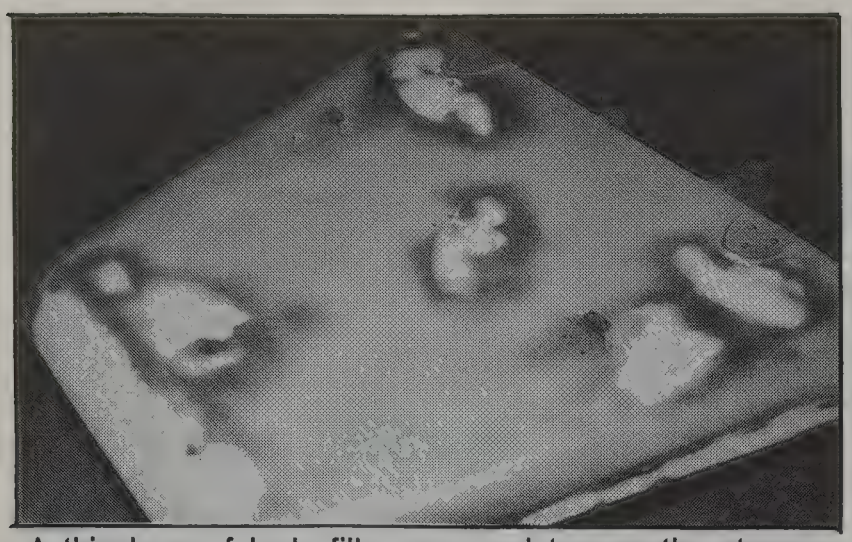
Sandblasting was done with Black Beauty, a tough, sharp abrasive that cuts rust quickly.



Instruments and steering wheel were masked off with duct tape prior to sandblasting the cab.

glossier." Kaplan expressed a preference for Montana brand hardener but felt that any generic one would do fine.

You would think that if you are applying flat or semi-gloss paint to vehicle you could spray it right over the primer, and many people do. However, all the professionals that I spoke to thought this was a bad idea. On a gloss finish, for example, you must sand the primer as smooth as possible. While that's not strictly necessary for a flat color coat, you should still smooth the primer either by sanding or with a scuff pad. Alan Haage, a major distributor of Aervoe paints,



A thin layer of body filler was used to smooth out some imperfections in the hood.

recommends wet sanding with 320-grit sandpaper, which is common practice in the automotive field.

For flat and semi-gloss paints, Ronnie Brooks, a body shop veteran, prefers 3M red scuff pads (Scotch Brite medium grade) to wet sanding because he feels it's easier to get in all the small nooks and crannies with them. And because the primer really isn't a water barrier, Ronnie prefers to get as little moisture on it as possible.

All of the dust produced by the sanding or scuffing must then be removed. Haage prefers a thorough washing with soap and water. Don Taylor, a noted resto author, opts for washing with clear water alone. Following the wash, you should go over the surface with a degreasing agent (there are many brands in any auto parts store).

Again, in an effort to keep the primer as dry as possible, Brooks prefers to skip washing with water and just use a wipe-on/wipe-off cleaner/degreaser. There are many equally good mass market brands from which to choose or you can do as I did and buy one for twice as much from an auto paint supplier. I got Omni Au MX 190 ($13/gallon). A tip on using a cleaner/degreaser: pour some on a soft cotton cloth, wipe it on with one swipe, and then wipe it off with a second, dry rag. Don't swirl it around as you would do with a spray windshield cleaner; that just moves the primer dust from one place to another and grinds it into the surface.

If you have an air compressor, use it to blow any remaining dust out of cracks and crevices.

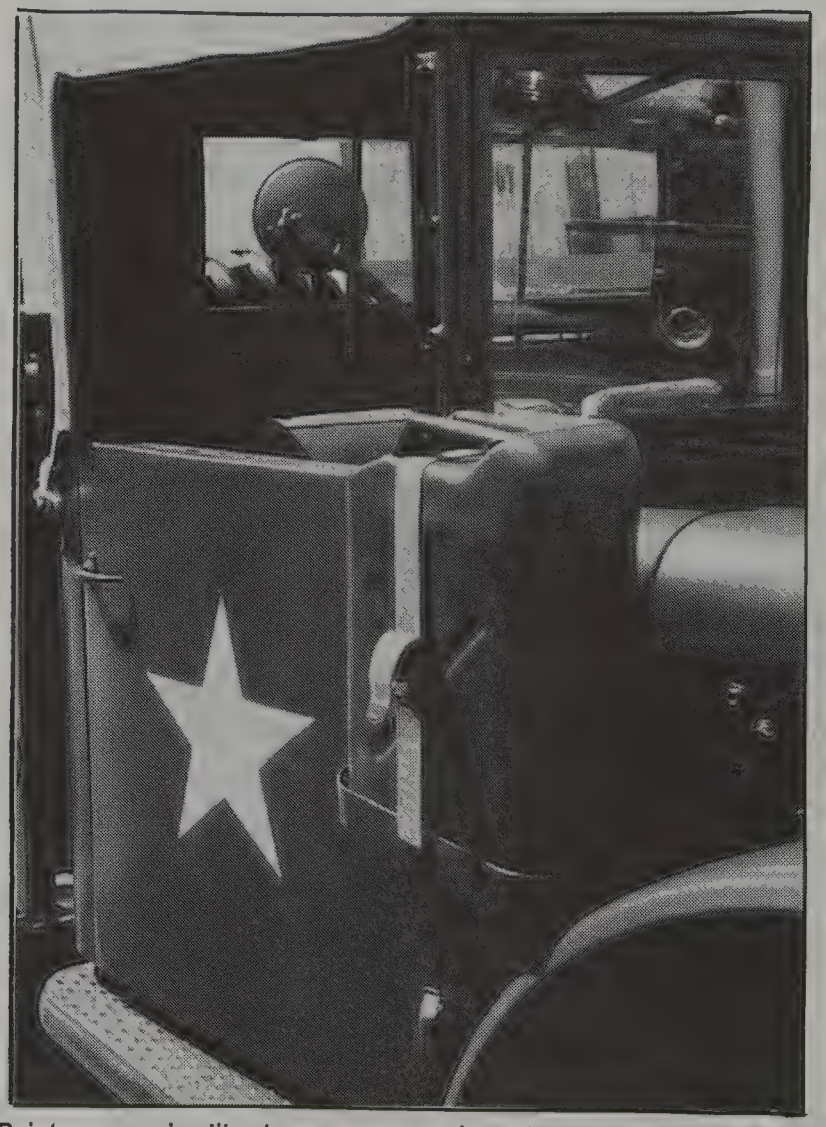
The final step before painting is to give the vehicle and parts a thorough once over with a tack cloth. A tack cloth is a

An array of parts after sandblasting and priming.

From a salvage yard, I got seats from an old 5-ton truck. Just two 5-ton seats will provide all the wood that I need for the side rails, back rails, and troop seats for my M37.

very loose weave piece of material (cheese cloth) that is impregnated with a sticky varnish that will pick up any fine dust still on the surface. Just go over the vehicle and parts very lightly with the tack cloth. *Do not rub the surface;* if you do, the varnish will rub off producing an unsatisfactory surface for your color coat. Also, don't leave the tack cloth sitting on the vehicle; if you do the varnish will quickly adhere to the paint and, if left for long, can even start to etch the primer.

Next issue: painting and reassembly.



Paint accessories like Jerry cans, rear view mirrors, lifting shackles, etc. at the same time as you paint your vehicle so the paint matches.

Painting, Reassembly, and Rude Awakenings

by David H. Ahl

When last I left you, the M37 project vehicle chassis and about a zillion parts had been sandblasted, primed, scuffed, and given a once-over with a degreaser/cleaner in preparation for the first color coat of paint. As I mentioned last time, I don't consider myself a painter so I hired Jim Munson, a friend with 1) a complete spray painting outfit and 2) experience painting everything from MVs to Porsches.

I spent a day readying my detached garage. Warning: don't paint in a garage attached to your house; automotive paint is nasty stuff and will poison your house for weeks. I got four 10' x 25' plastic drop cloths; two to hang on the sides and back of the garage and two for the floor. I also got some well-used 200-watt photo floodlights, which I set up on movable tripods, along with some cheap fluorescent shop lights, which I laid on the rafters. The more light, the better. Two big box fans—ones I didn't care much about because they were going to suck in a lot of paint—were placed in the door. A borrowed 5 hp 20 gal compressor rounded out the equipment.

The second phase of preparation was masking. This was fairly easy because most everything had been removed from the vehicle. The main item to be covered was the engine, which I did with a cotton drop cloth. I covered the radiator with some aluminum foil (good for large irregular surfaces) and tucked it in tight so the braces on either side would get a good coat of paint. I also covered the steering wheel with foil and masked off the instruments with masking tape, using an X-acto knife to cut around the glass.

Tuesday, July 7, dawned a warm, still day, perfect for painting. Jim came over, approved of the prep work, and mixed up a batch of forest green paint. As I mentioned last time, the mixing instruction on the Gillespie paint were not very specific, so we initially tried 10% thinner, found it a bit too thick and upped the ratio to about 4:1 (20% thinner).

Thinner Tips

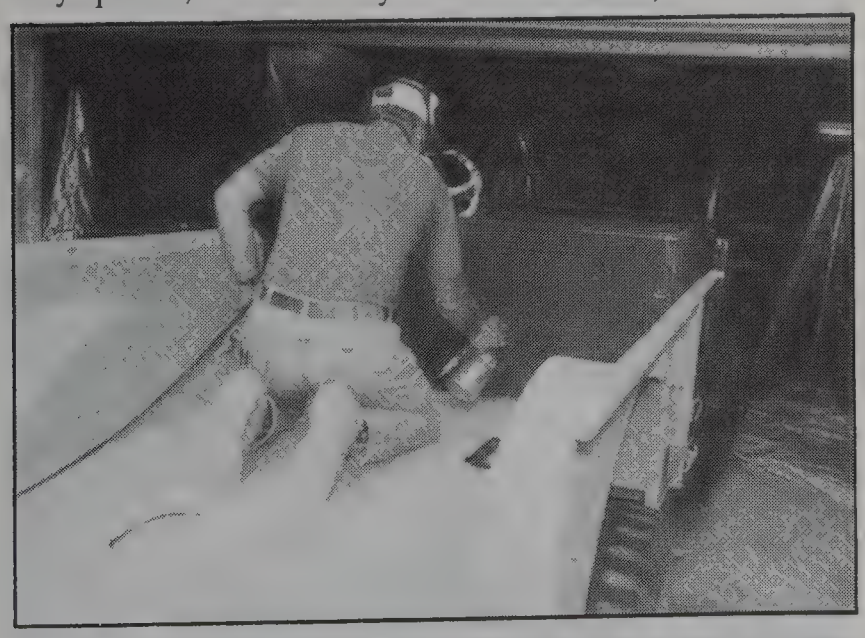
Most military paints can use one of several generic thinners. The main difference between them is drying time:

Standard thinner (mineral spirits)	Slow
Xylene (Xylol)	Medium
Toluene (Toluol)	Fast
VM&P Naptha	Instant

Drying time is affected by temperature too. If you use a fast drying thinner on a hot day, some of the paint droplets will be nearly dry by the time they hit the vehicle, which leads to a poor, powdery finish. Xylene is probably the best bet all-around, while mineral spirits is the most forgiving.

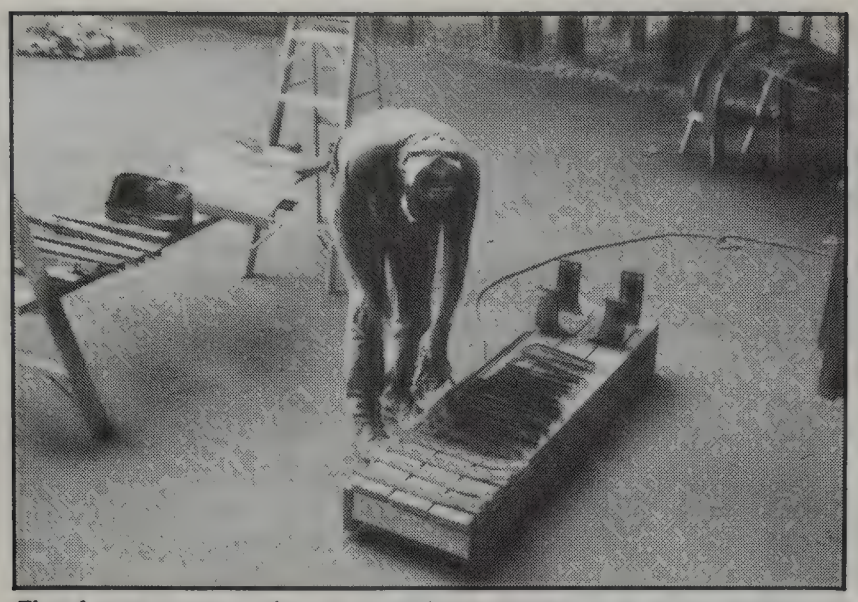
We mixed about a quart of paint at a time and by periodically shaking the gun, Jim made sure the pigment didn't settle out. He had a standard high-pressure spray gun—naughty, naughty, we would have been arrested in California—charcoal respirator and mask. What I didn't anticipate and what gave us a lot of grief was that, with all the lights, fans, and compressor plugged into the same circuit, the circuit breaker tripped every time the compressor tried to restart. We never did find a good solution for this problem other than for me to quickly turn everything off, run into the house, reset the breaker, run back out, and turn everything back on after the compressor restarted.

Originally, I had planned that once we got the chassis painted, we'd roll the truck outside to dry and set up some ladders with steel shelving uprights between them, hang the parts on wires from the uprights, and paint them in the garage. But because it was so calm outside we decided to set up the ladders and saw horses outside and paint right there



At long last, the M37 changes its colors from gray primer to a camo base coat of forest green.

Jim shot all the nooks and crannies including the inside of the side storage boxes.



The day was very calm, so we felt we could spray paint outdoors.

in the driveway. Needless to say, our driveway now has some strange greenish highlights.

Hint: you can make great parts hangers from wire clothes hangers; each clothes hanger will make four. But as my cousin, Frank Kiser, will attest, the bending is tough on your hands even with lineman's pliers and heavy gloves. Frank should know; he made about 200 parts hangers for us that morning.

While Jim was shooting paint on the chassis and Frank was making hangers, I hung up and laid out parts and mixed up new batches of paint. At about 11:00 a.m. Jim started shooting parts, and two hours later we broke for lunch. By way of a confession, I must tell you that I used the cleaner/degreaser only on the larger parts; anything less than about six square inches we painted directly over the primer.

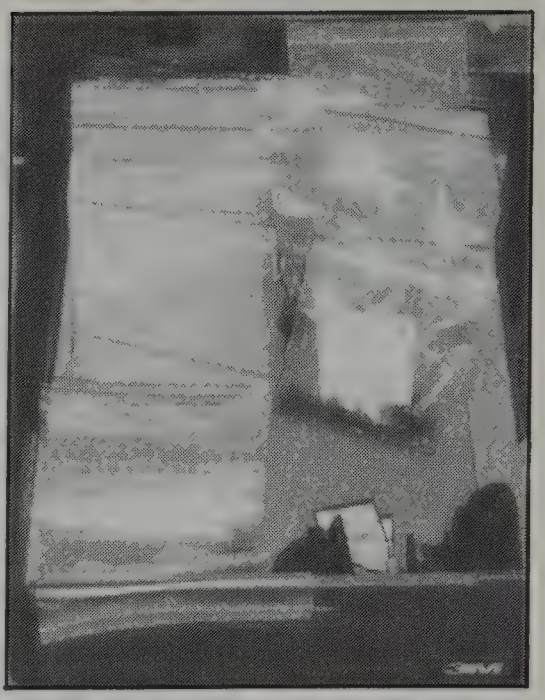
After lunch, we came back, and Jim shot the chassis, cab, bed, and every part with a second color coat. We gave it about 45 minutes to dry (things were dry to the touch in about 20 minutes) and then put a third coat down on surfaces that would not be accessible after the vehicle was assembled such as the back of the cab, front of the bed panel, hidden surfaces of fenders, the chassis under the bumper brackets, and the driver seat base.

Recall that in the last issue, I said that for good water protection flat paint needs 5 or 6 coats. We now had three coats of primer and two of color with another color coat to follow, so protection-wise, the vehicle was in pretty good shape.

Vehicle Reassembly

Now I had several hundred painted parts, several thousand rusty nuts, bolts, and washers, three manuals, and a zillion things to do. It was July 22, I had paid the entry fee and was committed to getting the M37 to the MVPA National Convention at Tobyhanna, Pennsylvania, by August 4, which was 13 days away, and I was in BIG trouble. My first action was to send Betsy to visit her family in the Adirondacks for a week. That way I could get up at 6:30 a.m. and work until 9:00 p.m. every day and not worry about anything or anybody else.

Psychologically, I think the thing I found most daunting was the pair of large cartons containing 42 (count them, 42!) zip-lock bags full of nuts and bolts for every single assembly on the M37. Each bag contained between 24 and 100 nuts, bolts, and washers. I replaced every washer with a stainless steel one; I replaced every single nut—except for the few 5/8" and larger ones; and I replaced scores of bolts. But I still had many hundreds of bolts—mostly larger 3/8" and 1/2" ones—that had to be wire brushed. What a pain! Put each one in the Vise-Grip, wire brush the six flats on the head, wire brush the head; put the head in the Vise-Grip, rotate it slowly and hit the bottom of the head and the threads.



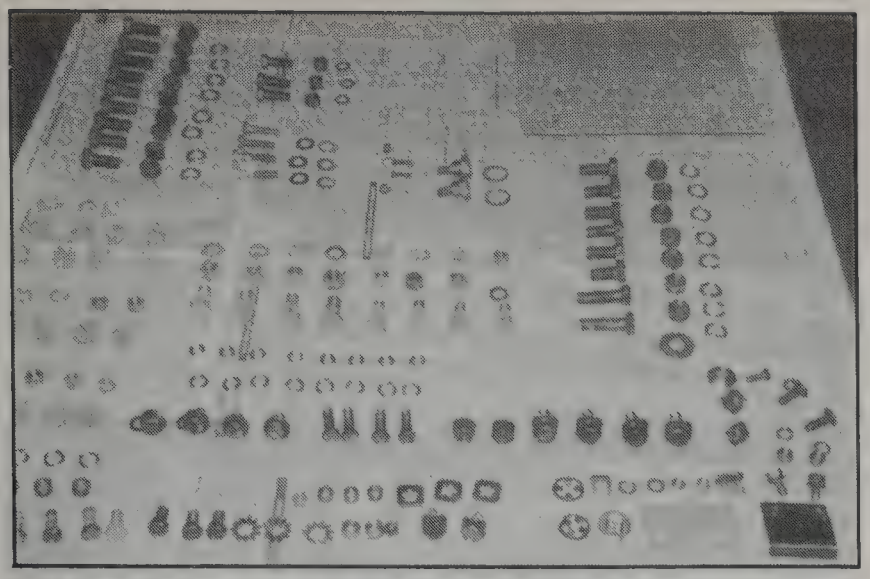
One of the two cartons of 42 zip-lock bags of nuts and bolts that had to be stripped of rust, primed, and painted. Yikes!

Do a bunch of them, slosh 'em in metal prep, dry 'em off, and spray 'em with primer. Wire brush some more (of course I periodically lost the grip from one and it would take off like a bullet, ricochet around the workshop, and end up under the furnace). Back to the paint table, turn over the primed ones in the last batch, and hit the other side with primer.

Do some more, hit the current batch with primer and the previous batch with paint, and on and on and on for four days from dawn to 8:00 or 9:00 at night. I'd relieve the tedium by taking a break to rebuild the windshield wipers, pull the mouse nests out of the seats, or clean the air cleaner.

Now, that is a story. I removed the air cleaner, poured the oil out, and disposed of it. The bottom of the trough contained a fair amount of grit which I wiped out. On the cover and bottom assembly, I expected that a coat of Blue Lightning paint remover covered by plastic wrap for 15 minutes in the sun would bring me down to bare metal. *Wrong!* In all, the air cleaner had seven thick layers of black and OD paint which took repeated applications of paint remover followed by many scrubbings with steel wool to finally remove. A thorough degreasing, cleaning, and priming followed. The air

The air cleaner bowl was full of dirt and grit.



I laid out the parts for painting in groups. The washers, nuts, and smaller bolts are new, while the larger bolts were wire brushed and cleaned in degreaser and solvent.

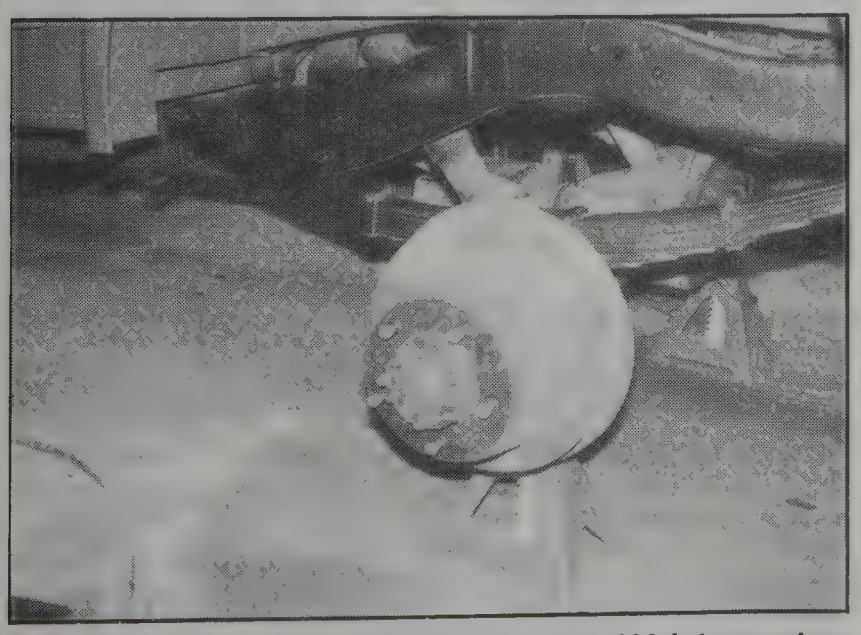
cleaner, voltage regulator cover, oil filter container, radiator, and other engine components—all of which had many thick layers of paint needed similar treatment. But today, at the price of some of my sanity, each item has two coats of semi-gloss black bar-b-que paint (see box).

Engine/Undercarriage Paint Tip

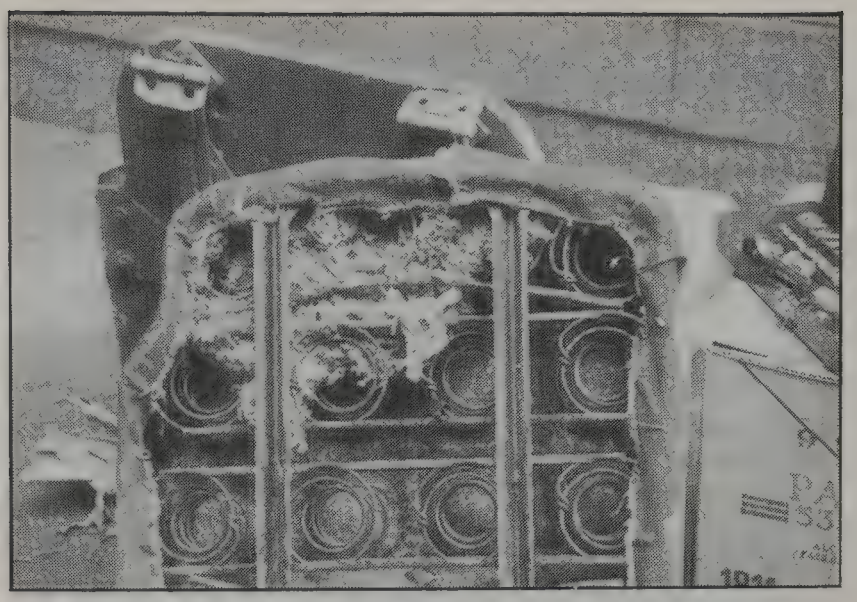
A well-known trick among auto and truck restorers is the use of black high-heat stove and bar-b-que enamel in engine compartments and underneath a vehicle. This semi-gloss spray paint, made by Rust-Oleum and Red Devil, withstands temperatures up to 1000° and resists grease, water, and weather. Eastwood sells a 300° radiator paint for seven bucks for a 12-oz. spray can, but you can buy the 1000° bar-b-que paints for about $4/can at Home Depot.

I did not, in fact, pull the engine and paint each surface. My philosophy is, "if it ain't broke, don't fix it," and the engine ran just fine, so I left it in place, replaced the spark plugs, tuned the carb, and painted some of the external items.

I also used three 12-oz. cans of the black bar-b-que paint on the undercarriage of the M37. When I say undercarriage, I mean springs, shocks, differentials, transfer, gearbox, drive shafts, bed and cab bottom, axles, muffler and pipes, and



The undercarriage was painted with spray cans of high-temperature semi-gloss black bar-b-que paint.



The entire driver seat was a giant mouse condo. In this photo, just a small amount remains.

basically everything underneath the vehicle. I wore my respirator to do this job (but, foolishly, not the mask) and when I got done I looked like a demented raccoon. The white T-shirt I had on—which is now a rag—is completely black in front except for some wrinkles; it's very weird. As compensation, the underside of the M37 looks *really* nice.

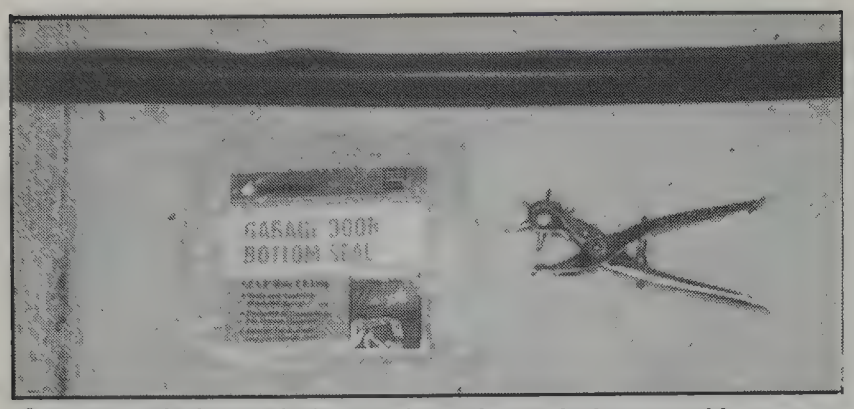
Next, I started reassembly interspersed with periodic trips to the hardware store for bolts, rivets, and sundry parts. An emergency call to Mark Dodd at Rapco for another gallon of paint. A run to FinishMaster for more primer. Need some clear sheet lucite for a light assembly. Need some silicon sealant for window strips. Need a male M-series connector. Need a 24-v taillight bulb. Need some oval-head screws for headlight rims. Need some black shrink-tubing. Need a grommet. And on and on.

I felt chained to the project, often waking up in the wee hours worrying that I hadn't yet faced up to making the wood bed seats, the side and back rails, or the rifle bracket. Refurbishing the seats in the cab was just a dream (oh, I'd gotten the canvas all right, from New Life, but the seats themselves were still practically mouse condos). The winch was still 300 miles away with Bob Stahl in Massachusetts. Two of my tires were falling apart; if they lasted another 20 miles it would be a miracle.

Actually, though, reassembly of the vehicle went much faster than the disassembly, mainly because the nuts and bolts mated easily, most holes lined up, and I could do things in more-or-less the right order. That is not to say that it was a piece of cake. Getting the glass into the window frames was no picnic even though I had lubricated the rubber with liberal quantities of liquid detergent. And if someone had made a tape of me trying to bolt on the spare tire carrier alone, it would have won a prize on America's Funniest Home Videos.

I discovered far too late that the guy who sold me the rubber strips for the front fenders sold me two right fender strips, so the holes were incorrect for the left fender. Moreover, after months of looking, I never found any black 3/8" split rivets for the rubber strips so I had to settle for bright silver 1/4" ones.

Tip: an NOS replacement windshield-to-cowl weather seal costs about $40 but most home centers carry a similarly shaped rubber garage door bottom seal. The Frost King one that I got, for example, is about 1/4" wider than the original



A poor man's front window seal can be made from a rubber garage door bottom seal. Use a leather punch to make screw holes.

M37 strip, but it cost less than $10. I just cut it to length, clamped the metal retaining strip to it, and used a leather punch to punch out the screw holes.

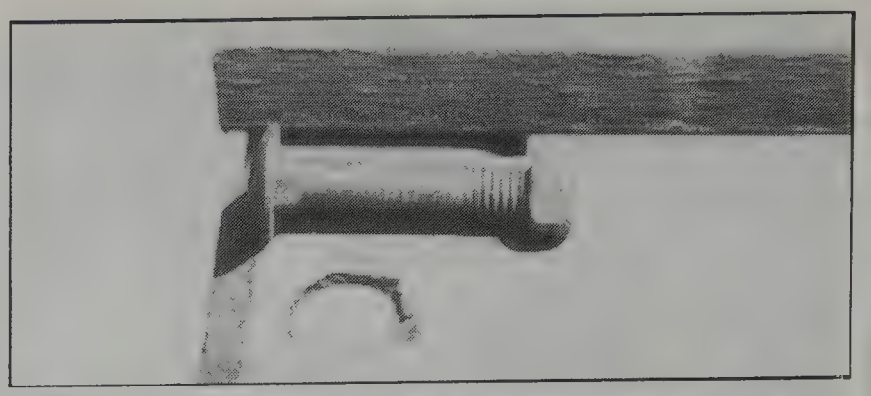
A thin layer of non-hardening sealant goes between the window frames on each door and the weather seal metal mounting strips. I used GE clear silicone rubber household sealant, but I was not too pleased with the outcome because it dried harder than the original (which was still soft after 40 years). Many years ago, I got a 2½" x 15' roll of a product called Miracle Seal—a black, semi-sticky substance, about 0.1" thick that can be cut and molded into any shape you want. I used this to seal the top corners of the hinged windshield and to stick the six reflectors into their metal frames. I probably should have used it for the weather seal mounting strips too. Miracle Seal is available from Revere Products (800-321-1976) for $12.95 per 15' roll. It's great stuff.

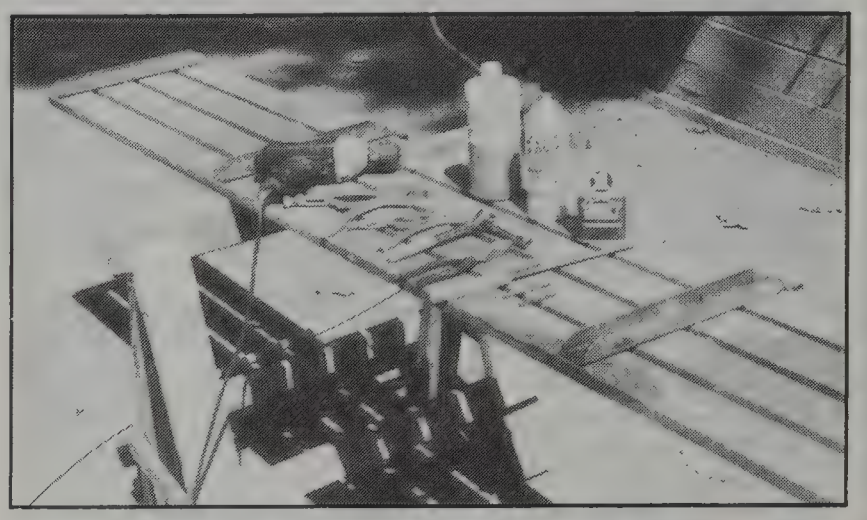
Once I got into high gear, it took four days to pretty much reassemble the truck. The most time-consuming aspects were whacking some of the brackets into better shape, after which they had to be primed and painted all over again. I had gotten some take-off winch bumpers to replace my old mangled ones, but I was reusing the old misshapen brackets. I also had to "adjust" the brackets for the taillights and front fenders. I had previously pounded out the old brackets somewhat, but I couldn't really determine their exact shapes until I put everything back together.

Making Seats and Side Rails

From a junkyard, I had purchased two seats and one backrail assembly from a 5-ton truck. The end of one seat was pretty mangled, but I wound up with four 13' boards, four 10' ones, and three 6' ones, plenty, I thought for my M37 which needed six seat boards, four side rails, and three back rails. Finally, I'd have an easy day cutting some wood to length, drilling new holes, and assembling the parts. HA!

The first thing I discovered was that the old, rusty carriage bolts holding the seat wood to the brackets were just not going to come out. I had previously slathered them with Liquid Wrench, but out of the 42 bolts I had to remove, only two came open. Next, I tried drilling the heads to fit a good-quality screw extractor. I was able to open about 10 more bolts this way until my #2 extractor broke. The #3 extractor required a 3/16" hole and I determined that by the time I drilled a starter hole and a deep enough hole for the extractor, I could drill off the entire head. This drilling was very time-consuming, so I tried grinding a slot in the bolt heads for a large screwdriver. I got two bolts out this way but I had to abandon this technique after the grinder got one bolt so hot





Top to bottom. (1) Old rusty carriage bolts are next to impossible to get out of old seats and side rails. (2) Tools and chemicals needed to disassemble the wood seats from a 5-ton truck included Liquid Wrench, rust remover, drills, screw extractors, Vise-Grips, socket wrenches, pliers, hacksaw, and more. (3) Cutting the freshly sanded old seat boards to length. (4) With virgin wood, it's good to apply a coat of polyurethane sealer before putting on any paint.

that it set the wood on fire. Next I tried chiseling away just enough wood that I could get a Vise-Grip on the bolt head, but this made a real mess of the hole. So what I thought would be a simple one-hour job wound up taking nearly eight hours and by 4:00 p.m. I was thoroughly fed up. But at least I had 11 nice oak boards for my M37.

I got out my oscillating sander and took the surface layer of paint off, cut the boards to length, and prepared to attach them to the M37 side and seat braces. That was when I had the rudest awakening of all. I had just assumed that the seat widths in all M-series truck were the same. But in fact the seats in 2½-ton and 5-ton trucks have four boards, each 3" wide whereas the seats in the M37 have three boards, each 3½" to 3¾" wide. The 5-ton seat boards were okay for my side and back rails, but too narrow for the seats. So after all of this agony I still wound up needing six new seat boards.

Another trip to Home Depot where I was shocked to find that 1x4 oak cost $1.70 per foot (I needed 36 feet), poplar cost 98¢ per foot, and clear first-grade pine cost 62¢ per foot. I decided to go with the pine for now and replace it later with some oak from the Mill at the Farm (973-927-1942). This outfit sells non-aged hardwood at exceptionally low prices, but you've got to let it thoroughly dry out in a garage or furnace room for a few months before you use it. Obviously, I didn't have that kind of time.

Incidentally, I filled the holes in the old boards with Plastic Wood (worked well) and, when I ran out, glazing compound (worked poorly). One person told me that he used body putty to fill in some wood, but it's so much harder than the wood that you've got to be very careful when you sand it not to leave a raised area.

It probably goes without saying, but when doing any kind of restoration work, it really helps if you can take your time and do it right the first time, rather than, as I did, cut corners to meet a deadline. Sure, my bed seats and side rails look fine for now, but this winter I'm going to have to replace the seats with genuine oak and knock out the glazing patches in the side rails, put in a better filler, and repaint everything.

Road-Worthy Tires for an M37

After reading a glowing review of the new Denman Coyote A/P radial tires in *Four Wheeler* and seeing that they were available in a 9.00x16 equivalent size (LT305/85R16), I called Denman about getting a set. No problem—they're available through National Tire & Wheel, 800-847-3287, for $135 each. We'll have a full review of the tire after we've had some experience with it off road and in the rain and snow, but so far it seems great, especially compared with the military non-directional tread. It's an inch wider (11") than the military tread and not quite an inch taller (36" dia.), but it puts a whole lot more rubber down on the road giving a feeling of stability that you just don't have with the ND tread. Although it's a six-ply tire compared with the military 8 plies, I didn't notice any leaning or swaying at all, even at 55 mph. The only small problem was finding five radial tubes with long, bent metal valve stems. Service Tire Truck Centers in Budd Lake, NJ, finally found some, but it was nip and tuck with the tires finally getting mounted just the day before we drove out to Tobyhanna.

Final Paint Coat

July 29, the day we selected for final painting, dawned sunny but with a gentle 5-10 mph breeze. Nevertheless, Jim felt that because of the better light he could do a better job painting the truck outdoors in the driveway than in the garage. This was also desirable because painting the now-assembled bed kicks back a tremendous amount of paint dust at the painter which even the best charcoal mask will not completely capture. I certainly do not recommend outdoor painting for a gloss finish, but for a flat-finish M37, it was okay.

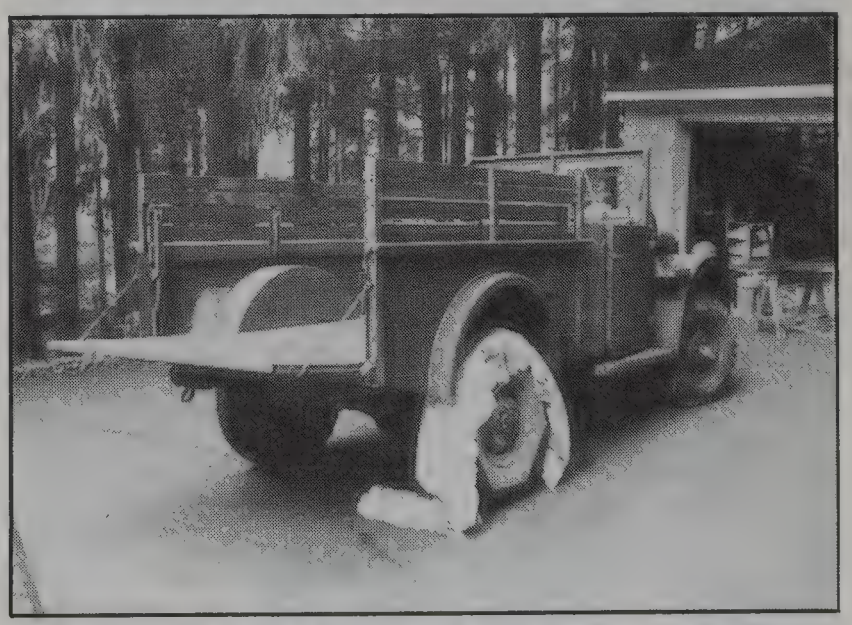
On this final coat, for a thinner we decided to use the faster-drying xylene rather than the slower mineral spirits. (Purists say that "thinner" is only for lacquer paint and that enamel paints use a "reducer," but I've been calling it thinner all my life and I'll continue to do so. See sidebar for definitions.)

This time around, masking was much more extensive than the first time, because the truck now had lights, windows, and tires, all of which had to be masked off. While rubber is not supposed to be painted, applying this rule calls for some common sense and also a knowledge of what was done when the truck was originally manufactured. During manufacturing, all parts were primed and painted before assembly. Generally, but not always, the vehicle got a second coat of paint after basic body assembly. Very little, if anything, was masked off for this painting step, so rubber welting around fenders was generally painted the body color. After basic assembly came the installation of wiring harnesses, door and window weather seals, lights, and reflectors, so these items are not painted.

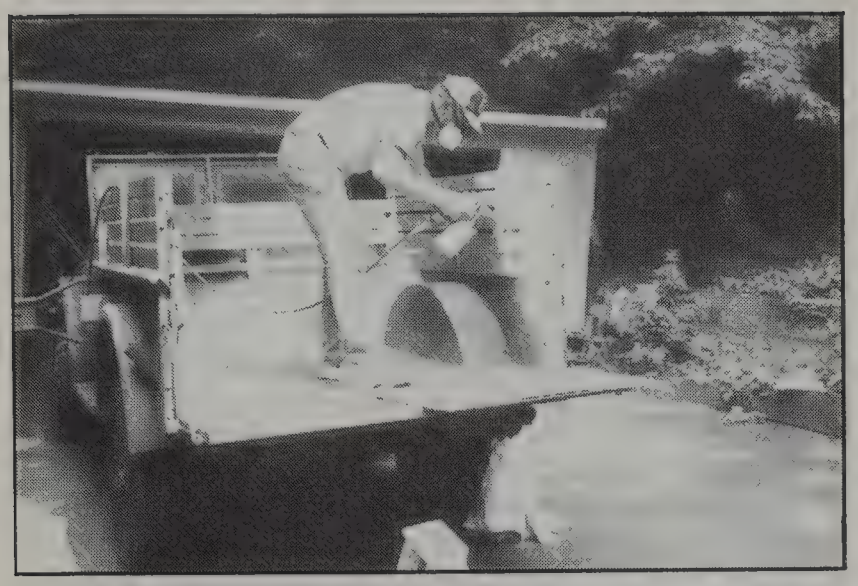
Thus, I attempted to mask off the rubber and other parts that would not have been painted originally. Some of these were quite a challenge such as the eight headlight mounting grommets and all the wiring.

Jim started by shooting the entire truck with a coat of forest green. He also shot a second coat on some of the parts and accessories that I deliberately left off, including the pioneer tools, cab framework, headlight guards, and bed uprights, corners, and cross members. In the 80° heat, the xylene-thinned paint dried to the touch in about 10 minutes.

We broke for lunch, returned, and mixed up a batch of light green, the second camo color. Most M37s were not



Tires, rubber parts, and windows were masked off on the assembled truck before the second color coat of paint.



Second camo color, light green, was applied using the M715 pattern in Technical Bulletin 43-0209.

painted camo before they were retired, the exceptions being those in STRAC units such as the XVIII Airborne Corps and certain National Guard units. Those vehicles were, in fact, painted camo in the field. I restored this M37 as it would have been in my unit (313th ASA Bn of XVIII Abn Corps at Fort Bragg) so it has the correct pattern and colors (forest green, light green, sand, and black) for the U.S. and northern Europe summer in contrast to the Vietnam jungle colors, Desert Storm desert colors, or U.S./Europe all-season colors that are more familiar today. The four-color camouflage paint scheme may seem strange and unfamiliar today, but, it conforms to Technical Bulletin 43-0209 of October 1976.

Actually, there is no camo pattern for the M37, but the TB directs you to use the M715 pattern, which is what we did. Normally, the entire camo pattern for the vehicle is put on with chalk and, as the paint is being shot or brushed, the chalk marks are wiped away (before painting, not after; if you paint over chalk, the paint will flake right off). Instead of using chalk, I lightly drew the pattern with a pencil eraser staying just a bit ahead of Jim's color gun.

Paint is shot over the rubber fender welting.

The only place where we had serious problems was the bed. Because there was so much overspray, Jim's sneakers picked it up, and we wound up with light green sneaker prints all over the dark forest green. The next day, after the paint had fully dried, I scrubbed hard with Comet on a Scotch-Brite pad and got most of the sneaker prints off. Yes, I know this is not something you'd normally do to a brand new paint job, but it worked and this is, after all, a *military* vehicle.

When painting the bed rails and seats, I held up a large piece of cardboard behind the slits in the rails and seats so the paint would not go into the cab or bed. The pattern on each side of each seat and rail is different, so we had to make some common-sense decisions of which color to carry around to the ¾" wood edges at the places where two patterns meet.

Based on Jim's experience shooting on the light green (45% of the vehicle), we decided that the paint gun would not be accurate enough for the sand and black, each of which would cover only 5% of the vehicle in quite small areas.

I added both of these colors the next day using spray cans and two cardboard masks. These were trivial mask patterns, simply a 3" wide slit about a foot long, one tapering off to a point to the left and one to a point on the right. My only purpose in using the masks was to hold down overspray, and in this, they were quite satisfactory. If I had really been striving for perfection, I would have called upon another friend, who is an expert with an air brush. I considered this, but felt that there was actually a danger in making the vehicle

More Than Just Paint

Thinner. Normally refers to lacquer thinner which is designed to work only with lacquer. Will strip off enamel and can be used to clean a paint gun after using enamel.

Reducer. A thinner for enamel and urethanes. Some paints can use a generic reducer such as mineral spirits, xylene, toluene, or VM&P naptha, while other paints require a specialized reducer matched to the paint.

Retarder. A reducer or thinner with an extra-slow evaporation time. For use in hot weather above 95°.

Hardener. Causes paint to dry to a harder surface; also speeds drying time. Finishes with hardeners are more subject to chipping. Also increases gloss of finish (a flat paint with a hardener will dry to almost semi-gloss).

Flexible Additive. A special solvent that allows the thin film of paint to flex without cracking. For use on plastic and rubber parts that may bend slightly.

Primer. Most primers prepare bare metal for paint top coat, but there are important differences between them. Standard gray *automotive primer* is a lacquer-based product with a rust retardant designed to be applied over properly prepared (etched) bare metal. *Self-etching primer* has an acid etch added to the primer. It must be followed by standard primer. *Epoxy primers* provide the best protection but are the most difficult to apply because the catalyst and primer must be precisely mixed and then applied with a spray gun. *Primer-surfacer* has a high solids content and covers slight surface imperfections; this is the best type of primer to use after sandblasting.

Sealer. This is used to protect an undercoat, often an old one, from solvents in subsequently applied topcoats.

Adhesion Promoter. This additive is useful when painting over an existing topcoat, particularly a baked-on finish that new paint cannot penetrate.

Cleaner (Wax & Grease Remover). Absolutely vital to use before every coat of primer or topcoat. Wipe on with one cloth, wipe off with a second. Consider an additional wipedown with an ammonia-based glass cleaner too.

Betsy takes the last traces of paint off the windshield.

look *too good*. Remember, until relatively recently, all camo paint was applied in the field, and air brushes, much less experienced air brush painters, are not going to be found on most bases.

This article is getting far too long, so I'll be back next issue with the story of the cab seats, tires, and several important accessories.

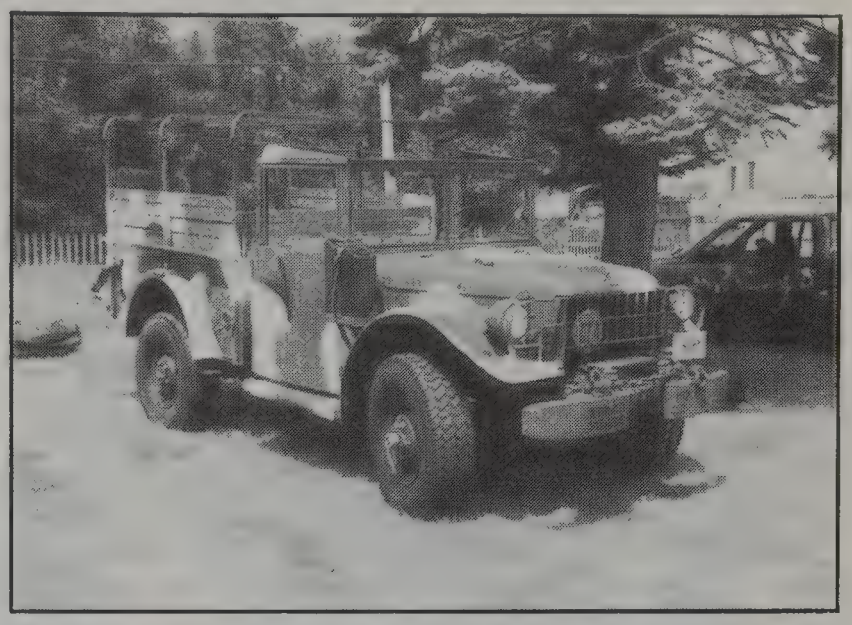
On to the Convention

I should mention though, that I finished the M37, at least to the point where I could drive it to the MVPA National Convention at Tobyhanna, with almost six hours to spare. Indeed, at 12:30 p.m. the night before driving out, I was applying black vinyl markings. I hadn't gotten the canvas on—thank goodness for sunny weather—and I confess that in the last-minute rush I put the cab top rail supports on upside down, which George Simione helped me to reverse the next morning.

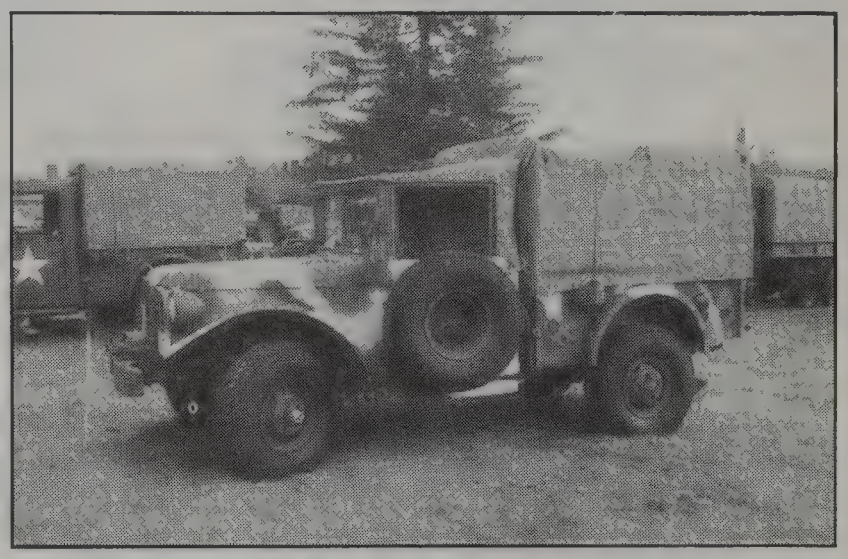
M37 Project Vehicle Earns 2nd Place Award in Restored Class at MVPA National Convention

Anyway, I had entered the vehicle in the Motor Pool Class ("good driving condition but with a few scratches and a little road dust"—actually a lot of road dust after the 75-mile drive to Tobyhanna). Some MVPA officials saw it, liked it, and persuaded me to bump it up into the Restored Class ("show room quality") with its much tougher judging standards. What I didn't know at the time was that Bill Kish, author of the MVPA Judging Standard & Restoration Guide, was unveiling at the show the absolutely pristine M37 that he had been working on for the last *ten years*. Bill's M37 was absolutely perfect in every single detail, and there was no way that it would not take first place. In contrast, my M37 had the very driveable but militarily incorrect Denman Coyote tires (-20 points), an inoperative fuel gauge (-5), and a bunch of other minor problems. Thus, at the banquet, Betsy and I were proud and honored when the magazine's project vehicle was awarded the #2 ribbon.

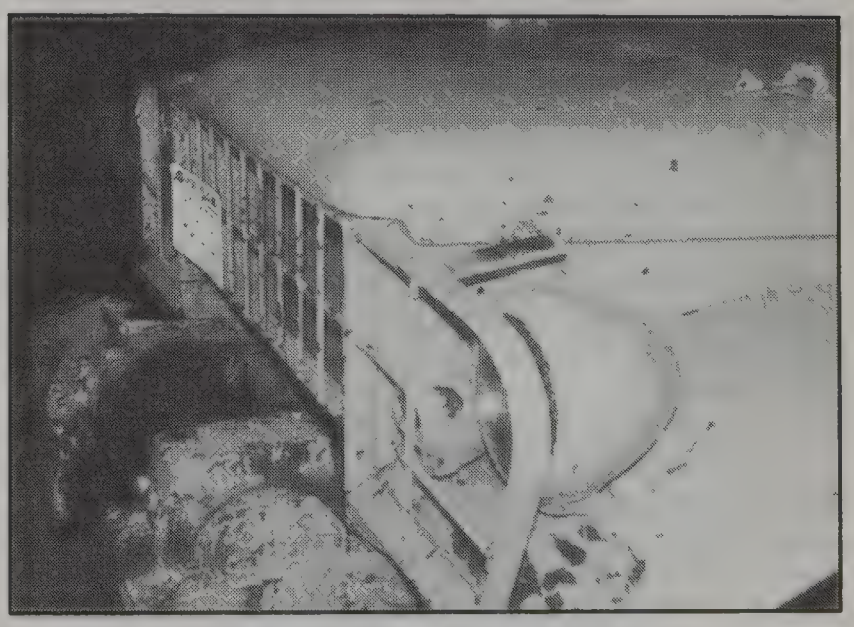
To be continued, at which time you will learn more about the differential gear oil running out of the oil flange seal on the right front tire on the 75-mile trip home. Also seats, rifle brackets, tires, and more.



We arrive at Tobyhanna; time to face up to installing the canvas.



M37 in the judging area with full canvas tied down.



The M37 less than a year ago: faded yellow (over red, over OD), badly bent, missing many parts (like seats), broken windows, no wood, torn canvas, extra brackets (and holes), rusty, tired.

1963 M37B1 ¾-ton Cargo Truck

Owned and restored by David H. Ahl

History

The M37 truck was conceived at a meeting between the Army and Chrysler Corp. at the Detroit Arsenal on August 1, 1948. The design drew heavily on parts used in WWII ¾-ton trucks and the civilian Power Wagon.

An initial production contract was awarded to Chrysler on May 31, 1949 and, after construction of six pilot models in 1950, production began in earnest in January 1951. Between Jan. 1951 and Aug. 1954, 63,191 M37s (and variants) were produced. Another 4,524 Canadian M37s were also produced. The need for light tactical trucks continued to grow and a follow-on contract was awarded on June 27, 1957 for the M37B1.

The B1 was fundamentally the same truck as the M37 although it had a number of small improvements such as new wire connectors, magnetic drain plugs, brake cylinder cups, and a slightly revised canvas top. Because the tooling had to be reconditioned, manufacturing did not begin until April 1958. When production ended in 1968, a total of 47,640 M37B1s had been built.

Restoring an M37B1

The vehicle that I restored, serial number 2668-0-01974, was built early in 1963. As far as I can determine, it was used by the Army only in the U.S. and was sold sometime in the mid-1980s to the Deer Park, Wisconsin fire department for use as a brush fire truck. The fire department made extensive modifications including a revised bed to hold a large water tank and pumping unit; addition of 12-volt lights, sirens, and radios; and different seats. In addition, they initially painted it red and later bright yellow (including instruments, undercarriage, and engine).

The fire department used the truck hard and when I took delivery on February 5, 1997, much of the exterior was damaged beyond salvaging (front bumpers, hood, tailgate, left fenders, headlight guard, headlight, running lights, reflectors, and numerous brackets). All of the wood, canvas, bed seat parts, blackout light, and stake corners were missing. Two windows were broken and none of them opened. Needless to say, all of the rubber had deteriorated but fortunately, having been garaged by the fire department, it was remarkably free of major rust.

In early March 1997, I made a preliminary list of 39 items that had to be done to the truck to restore it. Some were fairly extensive like "Bed Bows," which actually meant straightening six metal support posts, acquiring six stake corners, and making wood uprights, cross pieces, and center pole. My optimistic goal was to finish the major part of the process by the fall of 1997.

However, it was not to be because each time I took something off, a headlight for example, I discovered more problems underneath. When all was said and done, it was practically a frame-off restoration that took nearly 18 months from start to finish.

In that time, every single part has either been refurbished, replaced, or remade. Rust has been eliminated by sandblasting, wire brushing, or part replacement. Every nut has been retapped or replaced. Missing pieces and accessories have been acquired and added. The electrical system is back to 24 volts.

Today, nearly everything on the vehicle works correctly and it is one of the few stock M37s that can cruise all day at 55 mph. A major dealer said, "it's the best M37 I've ever driven."

Paint, Markings, and Equipment

The four-color camouflage paint scheme may seem strange and unfamiliar. However, it conforms to Technical Bulletin 43-0209 of October 1976. Most M37s were not painted camo before they were retired, the exceptions being those in STRAC units such as the XVIII Airborne Corps which were, in fact, painted camo in the field. This vehicle has the correct pattern and colors (forest green, light green, sand, and black) for the U.S. and northern Europe summer in contrast to the Vietnam jungle colors, Desert Storm desert colors, or U.S./Europe all-season colors that are more familiar today.

The unit markings indicate that this was Vehicle #2 of the Headquarters and Headquarters Company of the 313th ASA Battalion at Fort Bragg, NC. The 313th supports the 82nd Airborne as part of the XVIII Airborne Corps. HQ vehicle #2 would likely belong to the battalion headquarters company S2.

This M37B1 has a full pioneer tool kit on the tailgate, dual rifle rack in the cab (for M1 carbine or M16 rifle), document pouch with manuals (under driver seat), jack and tire changing tools (in side tool compartment), hand tools in canvas tool bag (side tool compartment), spare tire (on driver door), 5-gal. fuel can (front fender), and a radio and radio antenna. It also has bench seats for six in the bed.

Optional equipment includes a 5-gal. water can, three types of ammunition cans, jumper's bag with practice parachute, weapons bag with ammo pouches and hand grenades, various tie-down straps, helmets, gloves, and goggles.

Basically, the vehicle is equipped as it might have been on a practice exercise such as Swift Strike in the late 1970s.

1963 M37B1 ¾-ton Cargo Truck

Manufacturer	Dodge
Engine	6-cyl, 230 cid
Horsepower	94 @ 3400 rpm
Cruising Range	225 miles (9 mpg)
Top Speed	53 mph
Electrical	24 volts
Crew	2
Weight	8,147 lbs.
Payload	
Cross Country	1,500 lbs
Highway	2,000 lbs
Winch Capacity	7,500 lbs

For More Information

This M37B1 was restored by David Ahl of Morristown, NJ. For more information about military vehicles (ads, restoration how-to, history, etc.), send for a sample issue of *Military Vehicles* magazine ($5) or one-year subscription ($18) to Military Vehicles, 700 East State St., Iola, WI 54990, 800-258-0929.

I printed up copies of this sheet (2 sides) to give to people at parades, car shows, and static displays. It answers most people's questions.

Acknowledgements

Adam Metal Products, Ray Bentley
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Peter Berendsen
Blue Lightning
C.S. Coleman
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Denman Tire Corp.
Doncar Equipment, John Headley
Dragon, Inc., Mel Bernstein
FinishMaster Auto Paint Stores
Rick Frei
Front Line Military Vehicles
G & D Military Surplus, George Homfeld
Grainger Industrial Supply
Richard Greene Equipment Co.
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Phil Kern
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New Life Resource, Judith Peach
Orchard's Auto Glass
Portrayal Press
Rapco Parts Co., Mark Dodd
RDD USA
Sarco Inc.
SECO Parts & Equipment
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Superwinch, Inc.
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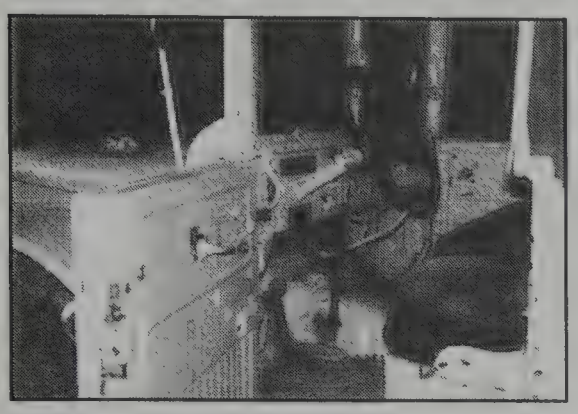
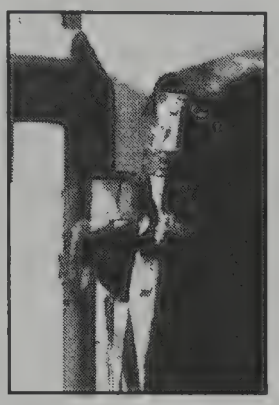
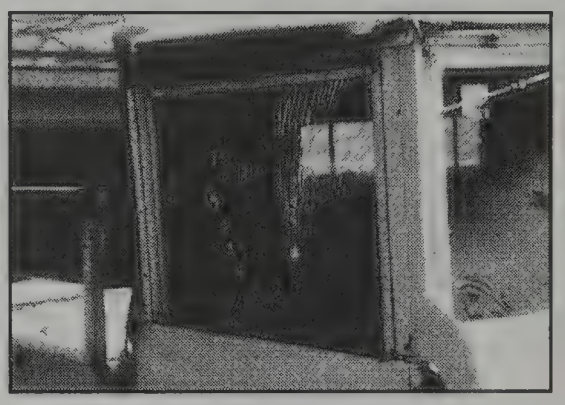
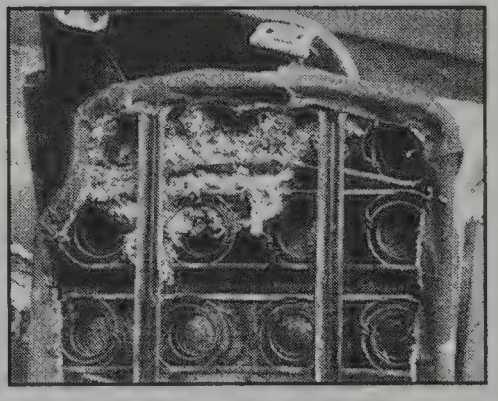
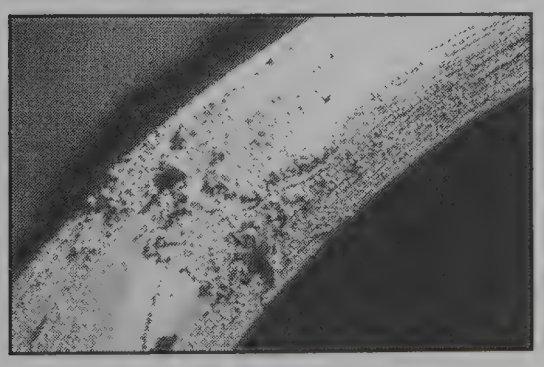
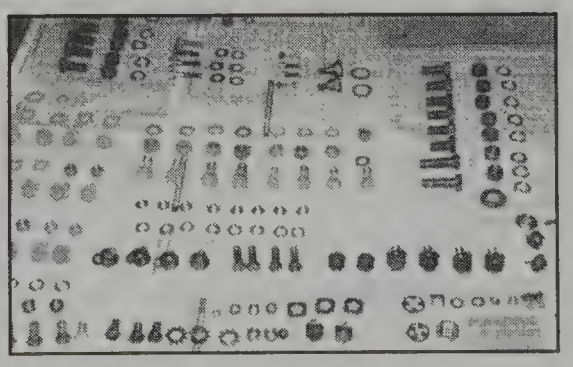
Weebee Webbing, David Pizzoferrato
Western Resources, Joe Francis
J.C. Whitney
Lou Windt
Lanny Wlodarski
W & S Repair Service, Bill Harbaugh

Restoring a Dodge M37

So you think the cost of buying a military vehicle is what you pay for it? Think again. Here, for your entertainment, is what it really cost to purchase, restore, and operate my M37 project vehicle for two years. Food for thought: now that I have over $12 grand into the vehicle alone, what is it worth on the open market? Do I hear any bids?

1963 M37B1 ¾-ton truck	$2,600
Transportation home (because friend who offered to tow it sold his trailer)	$600
Sales tax, title, registration	$176
Insurance (2 years)	$98
Superwinch locking hubs	$125
New body parts (door, hood, tailgate, bumpers)	$464
New canvas (cab, bed, seats, straps)	$550
New window glass, latches, weather strip, felt	$248
Fix flat tire	$16
Five new Denman Coyote tires	$650
Tubes, mount five new tires	$159
Handbrake drum, lining, and brake handle	$88
2nd Handbrake drum with lining (because normal humans can't rivet a lining to a drum)	$42
Labor to install handbrake	$50
New screw extractor, two taps, and wrench (because truck ate old ones)	$18
Set of 6 spark plugs	$42
2nd set of 6 spark plugs (because water poured through holes in hood and rusted 1st set)	$45
Rifle mounting kit, 2 replica rifles	$489
4 dinners out with wife (because "truck is taking over your life")	$118
Bed bows, corners, seats from 5-ton truck	$156
Lumber for seats (because seat boards from 5-ton truck were too narrow)	$38
Lights, wiring harnesses, disconnect switch	$132
Gallon of Liquid Wrench (not enough)	$14
Spare tire mount for bed (because door mounted ones not available)	$70
Spare tire mount for door (became available one week after purchasing bed unit)	$245
Chemical stripper & primer, respirator, goggles, labor for stripping	$852
Sandblasting, bodywork & priming (because chemical stripping missed too many spots and because rust spots were showing where primer wasn't put on soon enough)	$2,283
Goldeneye (James Bond) Videotape (to take mind off M37 for 2 hours)	$15
Pioneer tool rack, tools, fuel can, spout	$121
Antenna, antenna mount	$55
Paint, primer, prep cleaner, labor for prep & painting	$991
Weekend away with wife (because time spent on M37 is totally appalling)	$129
Bright yellow circular bridge weight plate	$55
Forest green bridge weight plate (because yellow is wrong for vehicle)	$13
Other stuff	$537
Additional garage bay (because existing four garage bays are full)	$15,000
Rebuild winch, parts & labor	$300
Hernia operation (resulting from lifting and fitting winch alone)	$4,782
Gas, oil, grease, routine maintenance (to drive 300 miles)	$81

The Bottom Line

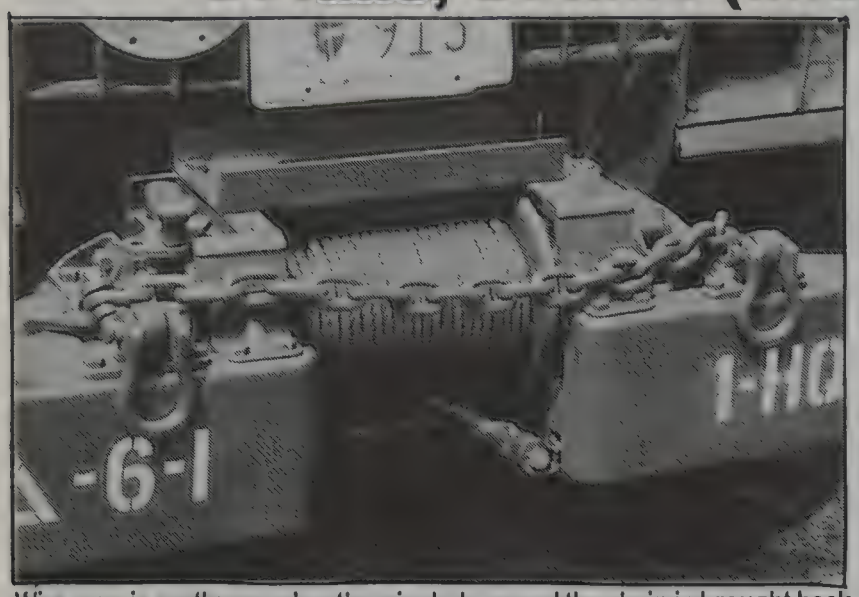
Brag to friends that military vehicle hobby is cheap; M37 cost only	$2,600
Vehicle + direct vehicle-related expenses	$12,403
Pretend that 600 hours of time spent on M37 could not have been spent at minimal wage flipping burgers at McDonalds	$3,600
Actual real-world cost of owning & restoring M37 for two years	$36,147

Betsy shows off our MVPA Convention restored class ribbon.

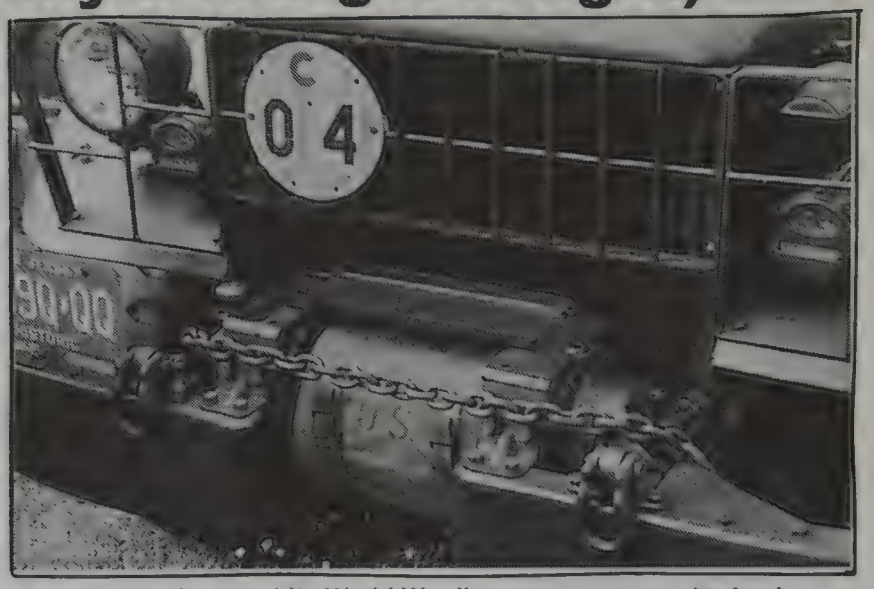
Top: Here is an M37 as delivered to the Army in 1954. It has not yet been delivered to a unit so it has only its USA number on the hood and no unit markings or national symbols (stars). This is a "plain Jane" M37 with no extras or accessories, although note that it does has a strip of webbing on the side of the bed that is used to hold down the three top bows when they are stowed.

Bottom: July 16, 1963. This M37B1 is on the weighing scales at Ft. Carson, Colorado as men of the 2nd Battalion, 10th Infantry Div. prepare to depart on Exercise Swift Strike III in the Carolinas. Weight plate indicates this M37 will be carrying a heavy load. As the 48th vehicle in the HQ and HQ company, this M37 is pretty far down in the chain of command. (As an officer in the XVIII Airborne Corps in the early 60's, I participated in several Swift Strike exercises including this one—DHA.)

Details, Details (and only a few get it right)

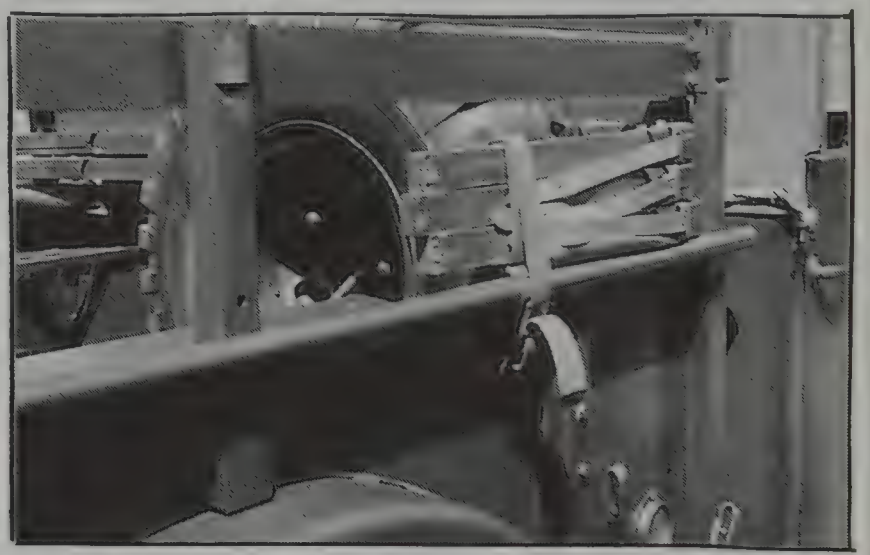


Wire rope is neatly wound on the winch drum and the chain is brought back from left to right as it ought to be. But where did that oversize winch cover plate come from? Also, the large stenciled letters and numbers are wrong; unit markings on an M37 should be in 2" Gothic characters.

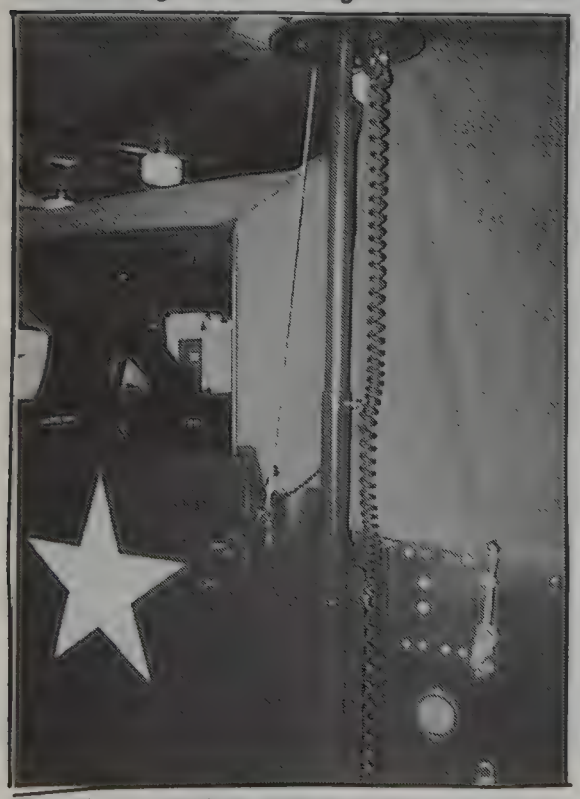


A very nice winch and its World War II canvas cover can be forgiven as there were still some around in the 50's. But a "C" on the weight plate, is that for show, or do you really have a trailer in tow?

Antenna mount is correct, but M37s rarely had the "Caution Overfill" notation by the fuel filler. And look up an article on canvas in *Military Vehicles Magazine* or *PS Magazine* for a lesson on tying your ropes.

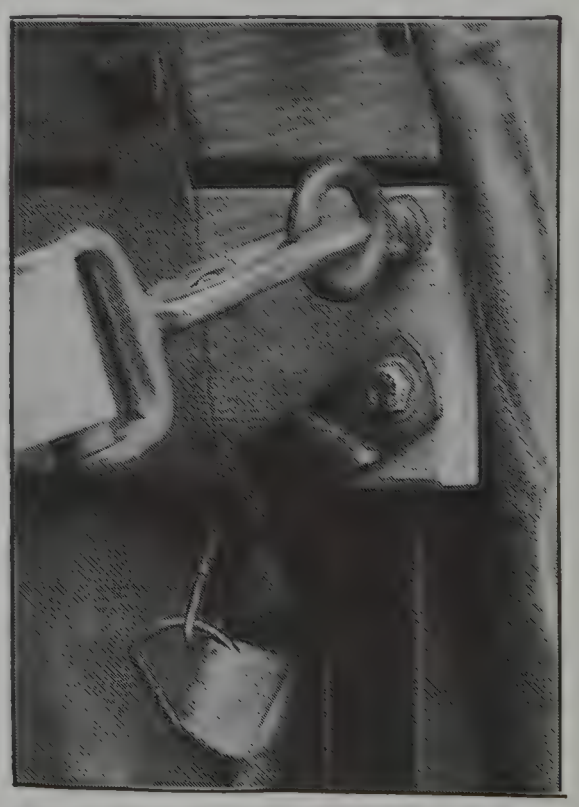


No complaints here. This is a very nice job of correctly tying down the three bows to the anchor that nobody seems to know what it is for.



There is no "official" place for a convoy light on an M37, so this is as good a place as any. Coiled cable came in much later; an M37 probably would have had a 14-ga wire running down the outside or the center of the support upright.

Rotating light (as installed here) is correct for an M37 and the support assembly is the right vintage. Wire runs inside the pipe as it should. Strobe lights came later and would be correct for am M880, CUCV, or HMMWV.



The pivoting clip under the ring holds the troop seats up. It is often put on backwards (it is correct here). The ring should be vertical (as it is here) although if the web safety strap has a swivel, it doesn't matter.

SECTION II

This section consists of 10 articles, most of which appeared in *Military Vehicles Magazine* over a four year period from 1997 to 2000. These issues were extremely popular with readers and all of them are now out of print.

Maintenance and repair of the M37 series of vehicles is thoroughly covered in the various military manuals. The operators manual, TM 9-2320-212-10, covers very basic maintenance like checks to be made before driving the vehicle, lubrication, and troubleshooting. The -20 manual covers maintenance that can be performed by the using organization. This is very comprehensive and covers every vehicle system from the engine to the bumpers. The -34 manual that normally covers rebuilding at the depot level was never published for the M37. Instead, several separate rebuild manuals were published including one for rebuilding the engine and drive train and one for rebuilding the power train. Other M37 manuals include one for carburetor servicing, for installing a hot water or gas fired heater, for servicing the transmission, for installing a hard top kit, for relocating the spare wheel carrier, and so on. There is also one very nice 466-page combination operators and organizational maintenance manual, TM 9-2030, which I strongly recommend you get if you are in any way thinking about buying an M37. After you have the vehicle, you may well wish to get several of the other manuals as well.

The articles in this section in no way replace the technical manuals. They either cover things that are not clearly spelled out in the manuals (carburetor and carb governor service, distributor rebuild, handbrake replacement, rear seals replacement) or they cover modifications that make the vehicle easier and safer to operate (free-wheeling hubs, all-purpose tires, better springs) or they focus on accessories and changes that enhance the operation or appearance of the vehicle (rifle mounts, door locks, 24- to 12-volt conversion, etc.)

To reiterate, you *must* have the vehicle manuals first. Use them for routine servicing, maintenance, repairs, and rebuilding. Then turn to this book as a guide and supplement to things that are not covered in the manuals.

HOW TO...

Overhauling the Carter ETW1 Carburetor

Text and Photos by Alan Bowes

No matter how well designed a carburetor may be, it's still a precision mechanism with a low tolerance for debris, corrosion, and wear. Eventually, you'll have to take action to reverse the ravages of time and the elements. The Carter Ball & Ball ETW1 (Fig. 1) and ETW1RU are well proven units that have graced the engines of thousands of military Dodges from 1943 to 1968, including my 1966 M37B1. When it's time to overhaul one of these venerable workhorses, this article may ease your task. *Note:* The ETW1RU has a different system for mounting the air cleaner, but is otherwise the twin of the ETW1. The Carter 561S, 565S, and 577S carbs are similar to the ETW1, but have different orifice sizes and no governor.

NOS carbs are rare, and rebuilt units may lighten your wallet by $125 to $185 US (exchange), making it tempting to overhaul it yourself. I rebuilt two carbs for this article, each with a different overhaul kit. The AFLA kit ($20) is adequate for most rebuilds but does not include as many brass parts as the NAPCO kit ($35-$45). On the other hand, the AFLA kit includes a better selection of aluminum passage plugs. In general, if the internal brass parts are still in good shape (as they often are), I'd suggest the AFLA kit. If the internal brass is badly corroded or otherwise damaged, get the more complete NAPCO kit. If your carb is in generally good shape and just needs cleaning, you might get by with a gasket set ($5 to $7). Examine all carb replacement parts carefully, since they don't always match the quality of the original parts. *Note:* The NAPCO kit's float level data is for a solid needle, but the kit contains a spring-loaded needle. In any case, I'd suggest getting a new Viton®-tipped solid needle valve assembly (NAPA/Echlin 2-3516), about $6.

The *TO 19-75CCA-6, Ordnance Maintenance, Carburetors (Carter)* manual is a subset of the earlier and larger *TM 9-1826A* manual, which it supercedes. It includes a carb theory lesson and a useful troubleshooting section, but only very basic overhaul instructions and nothing about the governor. This article fills in many gaps and walks you through the rebuilding process, emphasizing proper cleaning and reconditioning techniques and providing a few cosmetic restoration tips. However, it does not cover governor adjustments, which can be a bit complex and would require more space than is available here.

Safety First

- Follow all warnings and safety instructions when using gasoline, solvents, or other flammable or toxic substances.
- Be aware that some gaskets may contain asbestos, so take appropriate precautions.
- Disconnect the battery to prevent accidental cranking or sparks. Secure the cable clamp away from the terminal.
- Keep an ABC-rated fire extinguisher nearby.
- There may be lead deposits on carburetor surfaces, so don't put your mouth on the carb to blow out passages.
- Dispose of waste products safely and legally.

Fig. 1

Pre-Cleaning

Before removing the carburetor from the vehicle, clean the outside of the carb with an engine degreaser such as Gunk® and rinse it with a garden hose. Don't use a high-pressure washer, since it can peel flakes of metal off the zinc-alloy carb body. You can use aerosol carb cleaners while the carb is still on the engine, but be aware that some of these may dissolve paint.

Disassembly Tips

- In case there is any fuel left in the carb, do the initial breakdown outdoors, away from heat, sparks, or flames.
- Diagrams in the manuals and kits are NOT highly detailed, so note the location, size, and material of each part.
- Use a separate container for small, easily lost parts.
- Don't discard any old parts yet (you never know...).
- Use the correct screwdriver sizes and make sure the blades are square and sharp to avoid damage to screw heads.

Disassembly Procedure

1. Disconnect the battery cable (see *"Safety First"*).
2. Remove the air cleaner and disconnect the fuel, vent, and crankcase breather lines from the air cleaner elbow. Use flare-nut wrenches to avoid distorting the brass fittings. Plug the lines to keep debris and moisture out.
3. Disconnect the choke cable, crankcase breather control (if used) and throttle linkage.
4. Disconnect the air cleaner elbow support bracket(s).

5. Remove the air cleaner elbow from the carburetor. Don't damage the gasket (carb kits don't include one). *Note:* The ETW1RU uses a different attachment method.
6. Remove the two mounting nuts at the bottom of the carb and lift the carb off of the manifold. Stuff a clean rag or plastic bag into the hole in the manifold to keep debris out.
7. Remove the drain plug from the carburetor bowl and drain out any fuel. Do this outdoors, away from ignition sources.
8. I like to give the outside of the carb a good scrubbing in my parts washer, using Stoddard fluid (or equivalent). It may not remove every speck of paint and glop, but it gets it clean enough to make it nice to work on. *Note:* Don't immerse the entire carburetor in cleaning solvent.
9. Remove the choke bracket and spring from the bowl cover.
10. Remove the brass main vent tube from the bowl cover. Be careful not to damage the tiny orifices.
11. Remove the bowl cover mounting screws and lift the bowl cover off. Do this outdoors if there's still fuel in the bowl.
12. Lift out the step-up piston/plate/rod assembly. Remove the piston gasket (it probably remained in the piston well). Be careful not to scratch the sides of the well, and try not to damage the old gasket; you may want to re-use it.
13. Lift out the accelerator pump plunger assembly (or pull it out of the bowl cover if it came out with the bowl cover).
14. Remove the fuel intake needle valve (float valve) assembly.
15. Remove the float retainer clip and lift out the float.
16. Remove the accelerator pump discharge plug. There may be a fine spring under it that is not shown in the diagrams. Remove the spring with a pair of tweezers and tip the carb to allow the check ball to roll out. You may have to tap the main body gently with a plastic hammer to dislodge it. You can also use compressed air to blow it out, but make sure it doesn't hit someone in the eye when it flies out.
17. Remove the main jet. It's in a tight spot, so you may have to modify a tool to remove it. I just ground some metal off a nut driver to reduce its wall thickness (Fig. 2).

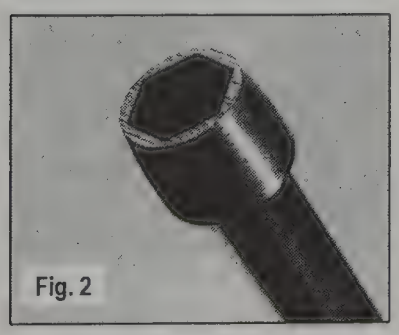


Fig. 2

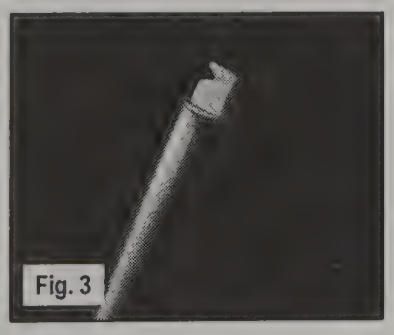


Fig. 3

18. Remove the idle orifice tube.
19. Remove the step-up jet and gasket.
20. Remove the check ball retainer at the bottom of the accelerator pump well with a long needle-nose pliers. Or, you can make a tool from a small flat-blade screwdriver by filing a small V into the side of the blade (Fig. 3). Slip the end of the tool between the wall of the pump well and the retainer, twist it (with the retainer in the V), and lift. Hold your thumb over the pump well in case the retainer is launched skyward. Be careful not to scratch the wall of the pump well.
21. Tip the carb body to let the pump inlet check ball roll out. If it's stuck, use the same technique as described above.
22. Remove the idle mixture screw and spring from the throttle body (body flange).
23. Cut the safety wire (if installed) and remove the three screws that secure the main body to the throttle body. Lift off the main body.
24. Loosen the clamp screw and remove the locating screw that secure the throttle lever to the throttle lever shaft. Remove the lever and washers from the throttle lever shaft. *Note:* For clarity, I will use the term *"throttle lever shaft"* for the outer shaft that goes into the governor, and *"throttle valve shaft"* for the shaft in the throttle body.
25. Clip the governor seal wire (if installed), remove the governor cover plate screws, and remove the cover plate.
26. Slide the throttle lever shaft out of the governor cover plate.
27. Disconnect the chain from the cam on the throttle valve shaft (Fig. 4) inside the governor. DO NOT alter the governor adjustments or you will have to recalibrate the governor.
28. Check the throttle valve shaft bearings for wear or corrosion (see *"Throttle Valve Shaft"*).
29. If the bearings are still *good*, reconnect the chain to the cam on the throttle valve shaft and don't do any further disassembly. You can now clean the parts. Go to *"Cleaning."*
    If the bearings are *bad,* it's normally best to replace the throttle body with an good used one, which may or may not come with a governor. If you have to remove the governor:
    a) Bend back the lock washer tabs from the nut holding the cam on the throttle valve shaft and remove the nut. *Note:* Don't bend the tabs any further than necessary, since you may have to re-use the lock washer.
    b) Remove the cam from the throttle valve shaft.
    c) Remove the three governor mounting screws and remove the governor body from the throttle body.
    d) Don't do any further disassembly at this point. Normally, I don't recommend removing the throttle plate or shaft, since bearing replacement and throttle plate alignment can be tricky. Go to *"Cleaning."*

Cleaning

This is a critical phase of the overhaul. Improper cleaning techniques can leave the carb dirty, or could even damage it.

Solvents and Cleaners: Carbs usually sport a combination of paint, grease, oil, gums, varnish, lead, gasket cement, etc. Every solvent has its strengths and weaknesses. I use Gunk for the first cleaning on the vehicle, Stoddard fluid for the next pass before disassembly, an immersion-type cleaner for most of the parts, and MEK for others. If a part has an enclosed area that can trap liquid, I don't like to dip it any immersion cleaners that contain acid (check the label). Also, don't boil carb body parts in caustic solutions, since it will, at the least, remove the protective conversion coating from the zinc castings.

Cleaning Passages: After cleaning carb body parts, traces of solvent and debris may remain in the passages. Shake out as much solvent as possible and rinse the passages with a garden hose (NOT a high-pressure washer). This flushes out most of the remaining solvent. Then you can use compressed air to blow out the passages and dry the parts. Remember, if solvent remains in the passages, compressed air can create a flammable mist. I use a rubber-tipped blow gun, since it seals tightly against passage openings, allowing the application of full air pressure. Avoid using wire to clear a passage, since it can dislodge flakes of metal or damage ball seats. If you can't clear a passage with compressed air, you can use a wire to clear it, but round off the end of the wire with some fine sandpaper to avoid abrasion

damage. If you can't clear a passage, you may have to remove a passage plug (see "*Passage Plugs*") to directly access it.

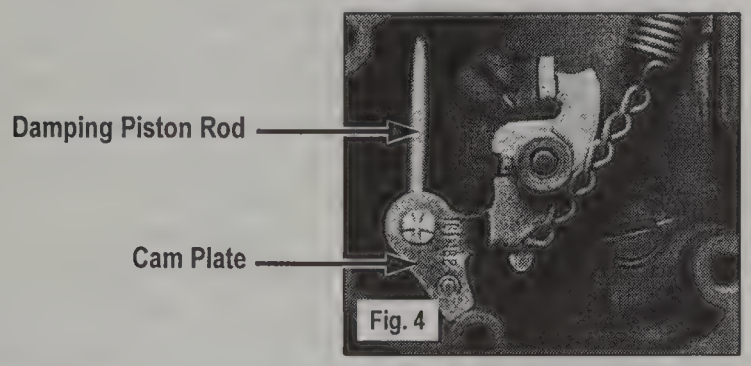
Corrosion or scratches on check valve seats can prevent check balls from seating properly. If the seats don't clean up with solvent and a soft brush or probe, you can epoxy an old steel check ball to the end of a small metal tube, apply a dab of fine valve lapping compound, and gently rotate it on the seat a few times. Be careful not to widen the seat too much.

Zinc Body Parts: The bowl cover and main body castings have unevenly dispersed layers and pockets of metal. High-pressure washing or bead blasting (even with plastic media) can blister the surface or peel metal flakes off the casting. Besides ruining the carb's appearance, flakes can come loose and block internal orifices. Bead blasting also removes the original protective conversion coating. If you must blast something to stay sane, do the outside only, and clean it thoroughly afterwards.

Bowl Cover: The choke shaft has a rubber or fiber seal. I prefer to clean the bowl cover manually with solvent, and drying it as soon as possible to avoid damaging the seal. If you use an immersion-type cleaner, the long immersion time may damage the seal. Also, if the cleaner contains acid, you don't want it to remain in the closed area at the end of the choke shaft (or saturating a fiber seal). If you want to use an acidic cleaner, remove the choke shaft and seal. (see *"Choke Shaft"*).

Main Carburetor Body: After removing all of the parts, the main body casting can be cleaned with any conventional solvent or an immersion-type cleaner. I prefer the latter; it's more economical in the long run than aerosol carb cleaners.

Governor Body: The damping piston in the governor body (Fig. 4) is permanently closed, but not sealed, so don't use an acidic cleaner that could cause damage if it seeps into the cylinder. Use MEK or some other solvent. It won't hurt to get a little solvent in the damping cylinder. Just work the piston rod in and out while holding the governor upright until you can't see any more seepage. After it's dry, drip some motor oil (I prefer synthetic) down the piston rod into the cylinder.



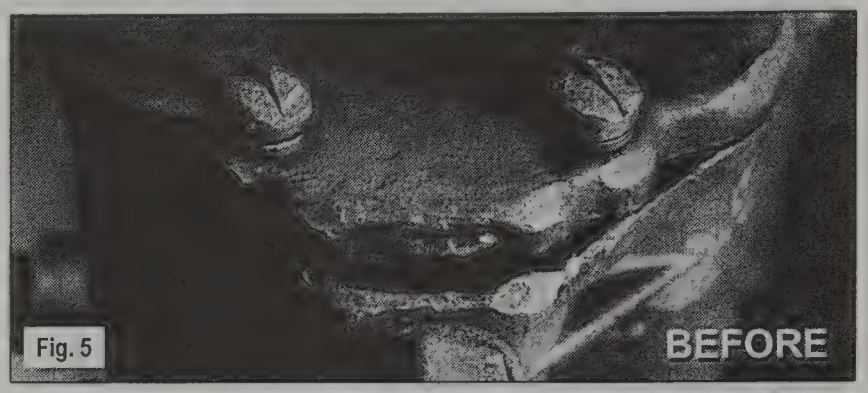
Throttle Body: I suggest conventional solvents like MEK or Stoddard fluid for cleaning the throttle body. One of the ball bearings on the throttle valve shaft is closed, but not sealed. If you get any acidic cleaner in this bearing, it could cause problems later. If you get solvent in the enclosed bearing area, it won't hurt anything. Just let it dry with the closed bearing upward to allow any solvent to drain out. Drip some synthetic motor oil into this bearing after it's dry.

Brass Parts: These parts can be cleaned with conventional solvents or immersion-type cleaners. Avoid using wire, drill bits, or other hard material to clean brass orifices. These are precision openings that can easily be damaged. A toothbrush usually works well.

Inspection and Component Repair

In general, check all parts for wear, corrosion, distortion, damaged threads, cracks, pinholes, etc. Many parts can be reconditioned; others may require replacement. This section provides suggestions for some typical problems.

Steel Parts: Some carburetor parts, such as steel screws or a rusty choke control bracket, are candidates for bead blasting, but they should be zinc or cadmium plated afterwards. For example, the bowl cover and mounting screws are often beat up from sloppy repairs or perhaps some frustrated bloke hammering on the carb to free a stuck float valve (Fig. 5). With filed and re-plated screws, a bit of sanding, and a new conversion coating, the same carb looks almost new (Fig. 6). New 12-28 fillister-head screws are hard to find, but I recently found some at Brownells, a gunsmithing supplier.



Throttle Valve Shaft: The throttle valve shaft must turn easily and smoothly for proper governor operation. Rust is a more common problem than wear. The shaft itself serves as the inner race for the ball bearings, so it's not just a simple matter of matching up a new set of bearings. It's also somewhat touchy to install new bearings and realign the throttle plate. If the bearings are worn or rusted, I'd suggest replacing the throttle body assembly with a good used one (about $20).

Throttle Lever Shaft: If the clearance between the throttle lever shaft and the sintered bronze bushing in the governor cover is over .020 inch, install a new bushing; it should be easy to match one up. To replace the bushing, pry out the oil seal, press out the old bushing, press the new bushing in, then press in the new oil seal. No driver or press? A bolt, nut, socket, and a few flat washers will work as a removal and installation tool.

The throttle lever shaft seal keeps dirt and moisture from being sucked into the governor workings and the throttle valve shaft ball bearings. If the old seal is cracked or hardened, it should be replaced. New seals are available.

Choke Shaft: A fair amount of clearance can be tolerated between the choke shaft and the shaft holes in the bowl cover, as long as the choke plate doesn't bind. There are no bushings, so if it's worn out, it may be easier and cheaper to replace the bowl cover with an NOS unit ($20) than to have it bored and bushed.

NOS units include a new choke plate, shaft, and seal. *Note:* Early bowl covers use one less mounting screw, but they should still work on a later main body.

The choke shaft seal is not critical unless you like to drive through deep water, although a badly worn or broken seal will allow a tiny amount of dirt and moisture to be sucked in. You might be able to match up a new seal, but you can also make one out of stiff felt (soak it with oil), or use a couple of snug-fitting Viton O-rings. If you're careful, you may be able to remove the seal retainer and replace the seal without taking the choke apart. If you don't have a driver of the correct size, a deep socket can be used as a driver.

If you have to disassemble the choke, remove the choke plate mounting screws, remove the shaft, remove the seal retainer, and lift out the seal. When you reinstall the retainer over the new seal, it must fit tightly. If not, you can tap on it against an anvil to spread it slightly. You could also apply a thin film of epoxy steel or fit-up compound, or stake it (though it doesn't look nice). When reinstalling the choke plate, use some thread locker on the screws, align the choke plate in the closed position with the screws finger tight, then tighten and stake the screws. Chisel-staking is almost impossible because of their position, but you can squeeze the ends of the screws where they stick out. A special staking tool would also work, if you have one.

Bowl Cover: Distortion of the bowl cover from uneven tightening or other abuse is common. To repair this, place a sheet of 320-grit (or finer) wet/dry sandpaper on a piece of plate glass, wet it, and slide the bowl cover mating surface along the sandpaper. Make a few passes, then have a look. High spots will show up as shiny areas. Run it back and forth until you can see shiny areas start to appear along the entire mating surface. If you have to take off more than about .015 inch, I'd recommend getting another bowl cover. Clean it well after sanding.

Main Body: Nicks on the mating surfaces of the main body are common. To repair these, glue some fine wet/dry sandpaper onto a flat piece of steel and use it like a file. I don't like using a file because the filings are much larger than sanding dust, are harder to clean out, and could block small orifices.

Orifices: Check all of the brass orifices (main jet, step-up jet, main vent tube, idle orifice tube, pump jet, etc.). Pay particular attention to the tiny holes in the main vent tube; one of these is about the diameter of a human hair and can easily become plugged. Don't use wire to clean these orifices unless solvent, brushes, and air fail to do the job. Damaged orifices should be replaced (the NAPCO kit has several new brass parts). For larger orifices, you could use a numbered drill bit of the correct diameter to ream out a hole, though this can be delicate. Another technique is to silver-solder the orifice, then drill it with the correct bit to its original size.

Float: Make sure the float is not bent and doesn't leak. Weight is critical. If you find a pinhole or crack, I'd replace the float with a new or used one rather than soldering it. WARNING: If there is any gasoline or other flammable substance inside the float, it is potentially explosive when heated.

Threaded Holes: If a critical hole is stripped, such as for the main jet or step-up jet, you may want to replace the casting. Some thread repair compounds may have enough fuel resistance to work, but check before you go to the effort. Thread inserts may work, though it can be difficult to install small inserts in tight quarters. There are also several high-strength, low melting-point solders that may work on zinc castings, but practice on some junk castings before using them on your carb body.

Passage Plugs: Several passages in the body castings are plugged with soft aluminum or copper "rivet plugs." You may have to remove a plug to clean out a badly clogged passage, or to replace a loose plug, but otherwise leave them in place. These are designed to be used once and discarded after removal. Carb kits include some new plugs, but not necessarily a complete set. The AFLA kit includes more plugs than the NAPCO kit.

To remove a plug, grasp it with a pair of sharp-edged pliers and twist it while pulling it out. If you can't grip it securely, gently tap a sharp wood-chisel blade between the plug and the carb body to lift an edge or move the plug far enough out to grab it with a pliers. Don't strike the chisel too hard, as it may distort the passage opening.

To install a plug, start it squarely in the hole, then press it in or else drive it in with a concave-head rivet set. You might also get by with a plastic hammer. It shouldn't require much force. If it doesn't go in straight, or if you hit it too hard or too many times, it can loosen up, possibly causing a dangerous leak.

Step-Up Piston Well, Accelerator Pump Wells: Check the inside of the accelerator pump plunger well in the main body, the accelerator pump piston well in the bowl cover, and the step-up jet piston well in the main body for roughness or corrosion.

Clean the wells with solvent and a small bristle brush. Don't use abrasives unless absolutely necessary, since they will remove the conversion coating, but if you have to use an abrasive, use a gray fine-grit Scotch-Brite™ pad or some 600-grit wet sandpaper in a twisting motion to lightly hone the surface. Don't measurably increase the well diameter, or you'll end up with an overly rich mixture under load, or a flat spot when you accelerate. If you damage the conversion coating, you should have it renewed (see *"Surface Finish"*).

Accelerator Pump Plunger: The NAPCO kit includes a complete pump plunger assembly, ready to install. The AFLA kit includes a replacement plunger and a new retaining pin, but no piston, spring, or guide plate. If you have the AFLA kit, replace the plunger as follows: Secure the *base* of the brass piston in a vise; don't clamp the hollow part of the piston. Use vise pads to avoid damaging the brass (dead-soft aluminum, lead, leather, cardboard, etc.). Knock out the old retaining pin with a pin punch (Fig. 7) that is smaller than the diameter of the pin. If

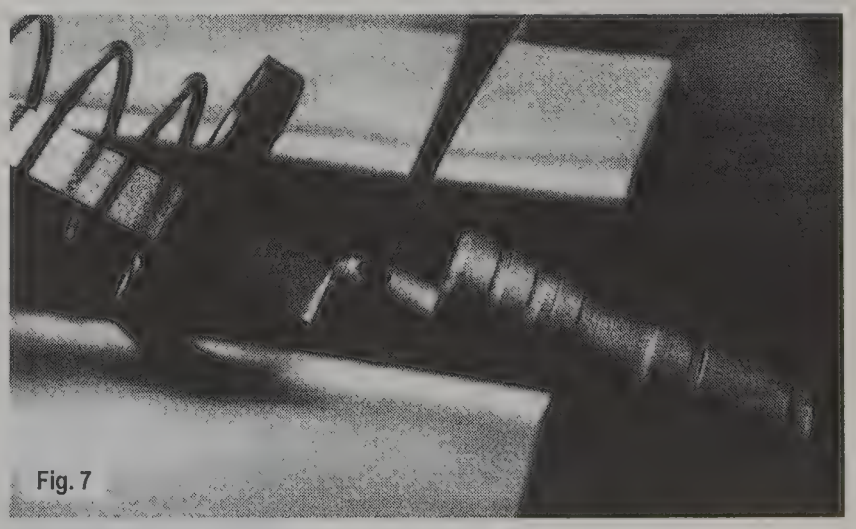


Fig. 7

it's a solid pin, one end will be a little larger than the other. Punch against the smaller end, so you don't drive the larger end down through the hole, enlarging it. Insert the new plunger and start the narrow end of the new pin in the hole. Drive the pin in

so that the ends are flush. *Note:* You normally should insert the new pin in the opposite direction from the original pin to make sure it fits tightly. If the new pin is a hollow steel roll pin, direction doesn't matter.

Governor Adjustments: Limited space precludes an explanation of governor calibration in this article. Usually, the governor won't need adjustment, but human nature being what it is, someone may have fooled around with the governor, in which case it probably needs recalibration.

This can be a bit tricky. There are two separate adjustments that interact with each other in a rather complex fashion. The brass adjusting screw changes the number of active coils on the governor spring, making it softer or stiffer and changing its expansion range. It also shifts the position of the end of the governor spring, but at a different rate. The slotted nut around the adjusting screw moves the screw and spring as a unit, without changing the number of active coils or affecting the spring expansion range. These adjustments don't just set the maximum RPM; they also change the governor's response curve, which can affect horsepower and torque curves. *TM 9-1826A* (1944) contains basic governor information.

Surface Finish: Zinc-alloy carb bodies were given a corrosion-resistant conversion coating at the factory, typically imparting a bronze hue to the castings. Some plating or carb shops can reapply this coating. I just had one re-chromated for about $30.00. Tell them not to bead blast the castings (chemical cleaning only) and don't expect perfectly even coloration. Of course, even the original coating was seldom consistent.

Caswell Plating has chromate conversion coating kits, which seem to work well on clean zinc-plated parts, but I don't know how well they work on zinc-alloy castings.

Another approach (exterior only) is to create the appearance of a conversion coating by spraying the carb with a translucent fuel-resistant bronze-tinted lacquer, available from the Eastwood catalog. *Note:* Some solvents may dissolve it.

DuPont 5717S Metal Conditioner, followed by 227S Conversion Coating, creates a flat gray conversion coating on zinc castings, which protects the metal. It doesn't look like the original finish, but it creates a good bonding layer, in case you want to paint or powder coat the carb. Powder coating is a durable, solvent-resistant alternative to painting, but it may cost significantly more to match specific colors.

Final Assembly and Adjustments

After all parts are cleaned, inspected, and repaired, you are ready to reassemble the carb. Make sure you have a clean place to work and all required tools, instructions, and diagrams. It's also handy to arrange the new parts in functional groups.

Assembly Procedure

1. Blow out all passages again with compressed air.
2. Oil the throttle valve shaft bearings.
3. If you removed the governor:
   a) Install the governor on the throttle body. Tighten the three screws and stake them with a semi-blunt chisel or a screwdriver. A screwdriver will more closely approximate the appearance of the original staking. The new staking in Fig. 8 was done with a chisel.

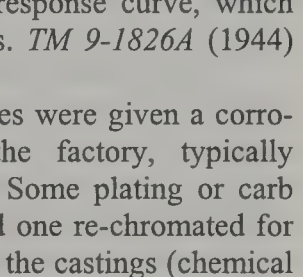


Fig. 8

   b) Install the cam, lock washer, and nut on the throttle valve shaft. The round tab on the cam fits into the notch on the damping piston rod. Bend the lock washer tabs up against the nut.
   c) Attach the chain between the spring and the cam.
4. Oil the sintered bronze bushing in the governor cover plate and place a few drops of oil in the gap between the bushing and the seal to act as an oil reservoir. Slide the throttle lever shaft into the bushing. Install the flat washer, spring washer, and throttle lever on the shaft. Install the locating screw (finger tight), tighten the clamp screw, then finish tightening the locating screw. Stake the locating screw.
5. Oil the small roller on the inside arm of the throttle lever shaft. Let a few drops of oil seep down the damping piston rod and into the damping cylinder.
6. Install the governor cover plate and gasket. Make sure the inside arm on the throttle lever shaft is in the proper position to push against the cam on the throttle valve shaft. *Note:* Two (or more) cover plate screws have safety wire holes drilled in their heads; use these at the top of the cover plate. They are for the "official" wire and lead seal that are installed after adjusting the governor.
7. Install the cap and gasket over the speed adjusting screw. If you don't have to adjust the governor, install the wire and seal through the cap and two of the governor cover screws.
8. Install the gasket and main carburetor body on the throttle body. Snug up the mounting screws, then tighten them evenly. Install safety wire through the screw heads so that the screws cannot turn counter-clockwise (see Fig. 9). *Note:* You can route the safety wire around either side of the carb, depending on which is more convenient.

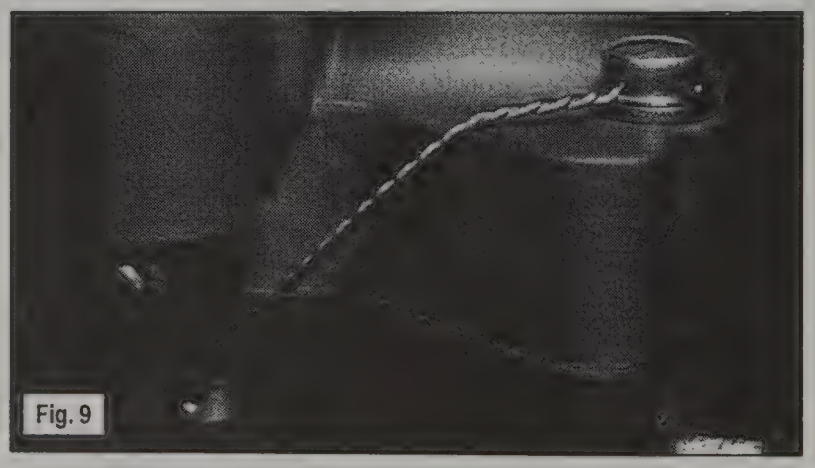


Fig. 9

9. Install the idle mixture screw and spring in the throttle body. Turn it in until it stops (don't force it), then back it out about two turns as a starting point. You will adjust this later.
10. Install the float bowl drain plug.
11. Install the idle orifice tube. Tighten brass parts firmly, but be careful not to strip the threads.
12. Install the main jet and gasket.
13. Install the step-up jet and gasket. *Note:* If you are installing a new step-up piston assembly and jet, slide the step-up rod into the step-up jet and make sure that it seals tightly before installing it. If not, try the rod in the old step-up jet. A leaky jet makes the mixture too rich under low-load conditions.
14. Install the pump inlet check ball (small one) and retainer.
15. Install the pump discharge check ball, spring, and plug.
16. Install the pump jet and plug (in the carburetor throat).
17. Install the float, hinge pin, and retainer clip.

18. Install the float needle valve/seat/gasket (assembly). *Note:* The needle may have a small internal spring and cap.
19. Adjust the float level. Press against the float lip with your finger to hold the needle valve shut and hold the float retainer clip down against the float hinge pin. For a solid needle (either all metal or Viton tipped), it should measure 5/64 inch (2 mm) from the top surface of the main body casting to the top of the float. Bend the float lip to adjust it. Make sure both float halves are at the same height.

    Note: The NAPCO kit includes a spring-loaded needle, but the setting information (5/64-inch) is for a solid needle. I tried this setting with both needle types at the same fuel pressure (5 psi). The spring-loaded needle produced a fuel level 3/16 inch lower than the solid needle, which will result in a slightly leaner mixture and increased tendency to lean out in rough terrain or on steep slopes. Also, the needle spring strength can vary from brand to brand, which affects fuel level. It's hard to say whether it would be enough of a difference to cause problems. If you have a spring-loaded needle, you might try a smaller float setting, but make sure the float can't rise high enough to bang against the bowl cover (hold down the float retainer clip and lift the bracket between the float halves until it stops, making sure that no part of the float reaches the top of the casting).

    No matter which carb kit you have, I'd recommend getting a new float valve assembly with a Viton-tipped solid needle (NAPA/Echlin 2-3516). This will allow you to use the 5/64-inch float setting. Also, the newer high-fluorine Viton compounds are compatible with oxygenated, alcohol-bearing fuels (I'm not sure about the older Viton tips).
20. Install the step-up piston gasket in the step-up piston well. If the kit is old and has a resilient piston gasket, there is a chance that it may soften up in fuel containing alcohol. You can test it by soaking it in some "gasohol" (oxygenated gasoline with methyl alcohol). If it swells, re-use the old fiber gasket or get a newer kit. The gasket should fit snugly on a narrow landing in the well and not protrude into the bore where the spring can snag on it.
21. Install the step-up piston/spring/plate/rod (assembly).
22. Install the accelerator pump piston/guide/spring/plunger (assembly). Don't worry if the seal feels loose in the well; it will expand when wet with fuel.
23. Take a final look inside the carb to make sure everything is clean and in order. Check the carb against your diagrams.
24. If removed earlier, install the choke shaft seal, choke shaft, and choke plate in the bowl cover (see *"Choke Shaft"*).
25. Install the choke bracket and spring.
26. Place the bowl cover gasket on the main body (you shouldn't need gasket cement) and lower the bowl cover onto the main body while gently guiding the accelerator pump piston up into its cylinder in the bowl cover.
27. Install the bowl cover mounting screws and snug them down, but don't tighten them all the way. *Note:* The float retainer clip will stick up slightly above the main body, but it will be squeezed down when you tighten the screws.
28. Check the main vent tube orifices for debris, then install the main vent tube and gasket *finger tight only*.
29. Check the bowl cover for fit, then evenly tighten the bowl cover mounting screws and the main vent tube. *Note:* After an hour or so, you may want to tighten them again.
30. Install the carb and gasket on the intake manifold. Tighten the two mounting nuts evenly.
31. Install the air cleaner elbow and gasket on the bowl cover (the ETW1RU air cleaner mounts differently).
32. Consult your maintenance manual for the following tasks:
    a) Install the support bracket(s) on the air cleaner elbow.
    b) Reconnect all vent and breather tubes.
    c) Reconnect the choke control, manifold breather shut-off control (if used), and throttle linkage. Adjust the controls for full travel from open to closed positions. Use a new cotter pin on the throttle rod. Oil the ball joint where the throttle rod connects to the throttle lever.
    d) Clean the in-tank and/or in-line fuel filters.
    e) Reconnect the fuel line to the carb.
    f) Clean, refill, and install the air cleaner.
    g) Start the engine, checking for any leaks.
    h) Adjust the idle speed and idle mixture. (Set the idle mixture for maximum manifold vacuum.)
33. If required, adjust the governor according to *TM 9-1826A*. Install the cap screw and gasket over the adjusting screw and thread the seal wire through the cap screw and the two upper governor cover plate screws. Slide the lead seal onto the wire and crimp it. A stamp from a military-rebuilt carb is shown in Fig. 10 and Fig. 11 (obverse and reverse).

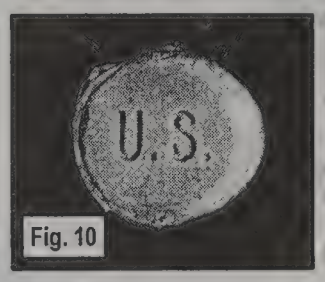


Fig. 10

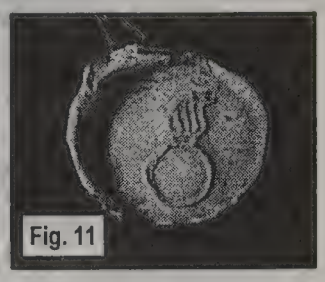


Fig. 11

34. Do a final inspection for leaks, loose parts, etc.

Comments or Questions?

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Some Sources

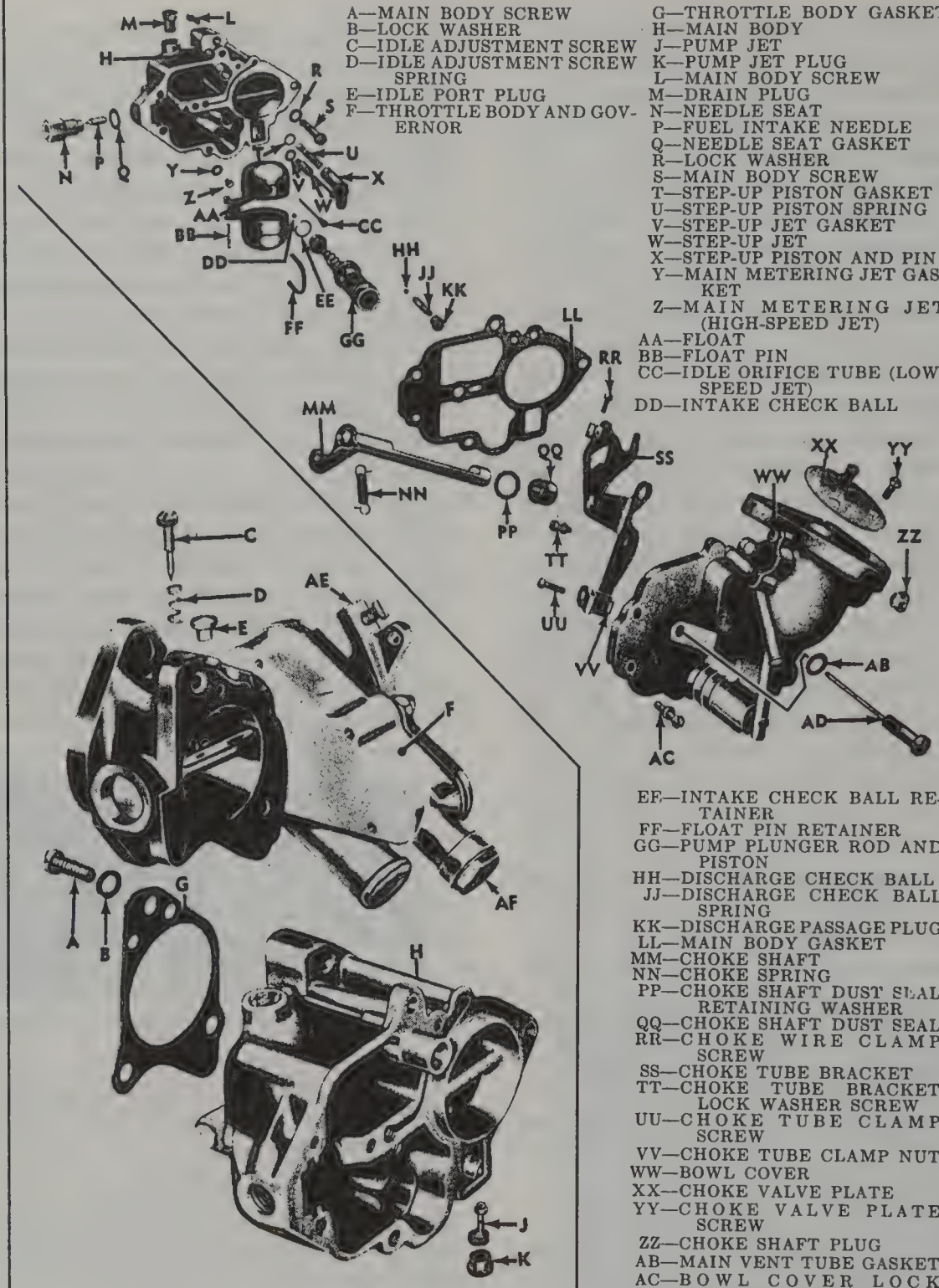
Carburetors, kits, manuals, and parts:

Adirondack Dodge Parts — 800-932-8020
Antelope Valley Equipment — 800-521-8518
Camo, Inc. — 717-476-9333
Thomas W. Murray — 302-736-1790
e-mail: murco@dmv.com
Surplus City Jeep Parts — 800-353-3772
http://www.surplusjeep.com
Trader John's Outpost — 847-741-3388
http://www.trader-johns-outpost.com
Vermont Commercial Salvage — 802-864-4762
Vintage Power Wagons — 515-472-4665
http://home.mainsite.com/lathrrs/vpwads/vpwad.html

Metal finishing supplies, screws, tools, etc.:

Brownells — 515-623-5401
Caswell Electroplating — 315-597-5140
http://www.caswellplating.com
The Eastwood Company — 800-345-1178
http://www.eastwood.com

Gunk is a trademark of the Radiator Specialty Company
Scotch-Brite is a trademark of 3M Corporation
Viton is a trademark of DuPont Dow Elastomers



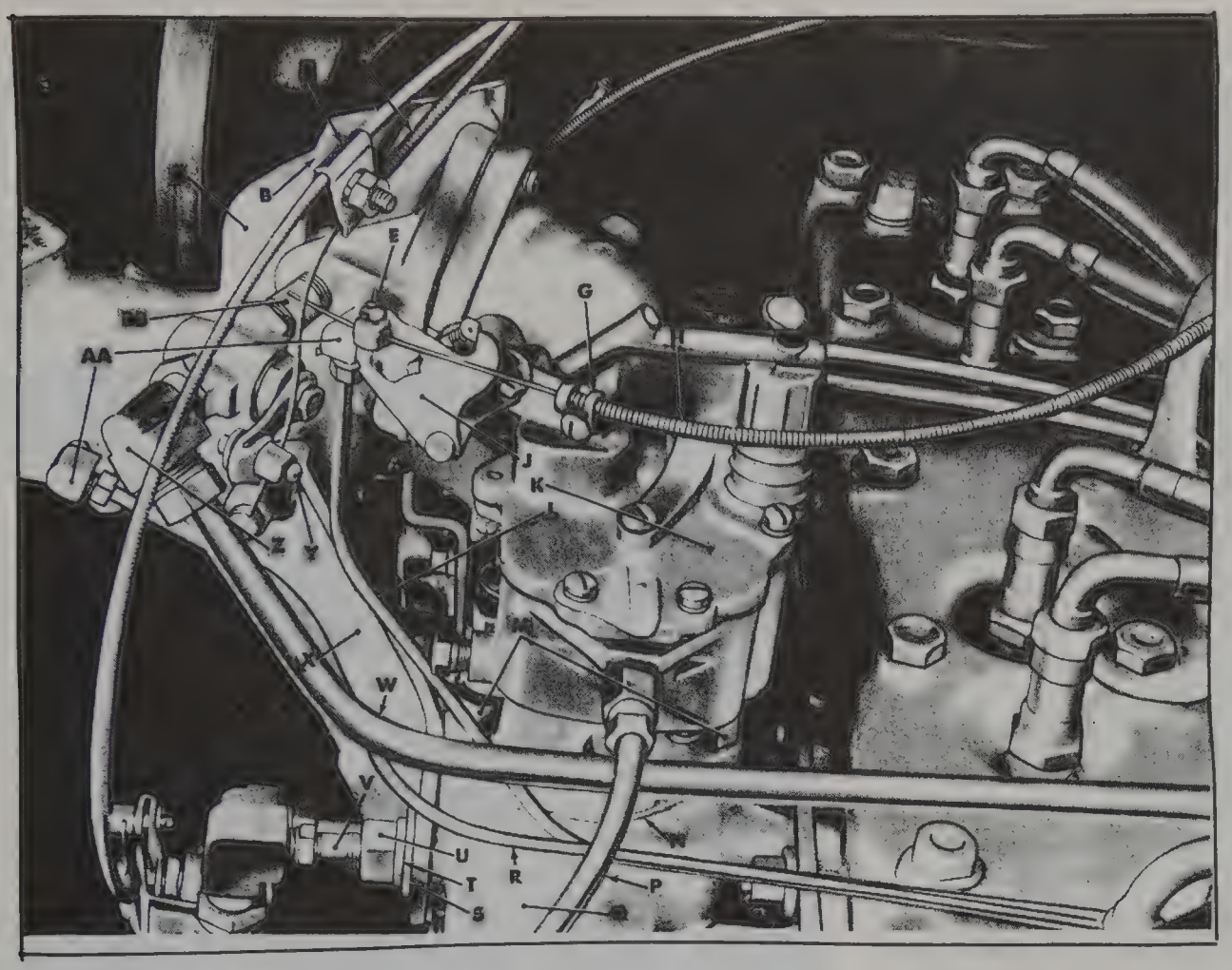
Carter ETW1 Carburetor

A—MAIN BODY SCREW
B—LOCK WASHER
C—IDLE ADJUSTMENT SCREW
D—IDLE ADJUSTMENT SCREW SPRING
E—IDLE PORT PLUG
F—THROTTLE BODY AND GOVERNOR
G—THROTTLE BODY GASKET
H—MAIN BODY
J—PUMP JET
K—PUMP JET PLUG
L—MAIN BODY SCREW
M—DRAIN PLUG
N—NEEDLE SEAT
P—FUEL INTAKE NEEDLE
Q—NEEDLE SEAT GASKET
R—LOCK WASHER
S—MAIN BODY SCREW
T—STEP-UP PISTON GASKET
U—STEP-UP PISTON SPRING
V—STEP-UP JET GASKET
W—STEP-UP JET
X—STEP-UP PISTON AND PIN
Y—MAIN METERING JET GASKET
Z—MAIN METERING JET (HIGH-SPEED JET)
AA—FLOAT
BB—FLOAT PIN
CC—IDLE ORIFICE TUBE (LOW-SPEED JET)
DD—INTAKE CHECK BALL
EE—INTAKE CHECK BALL RETAINER
FF—FLOAT PIN RETAINER
GG—PUMP PLUNGER ROD AND PISTON
HH—DISCHARGE CHECK BALL
JJ—DISCHARGE CHECK BALL SPRING
KK—DISCHARGE PASSAGE PLUG
LL—MAIN BODY GASKET
MM—CHOKE SHAFT
NN—CHOKE SPRING
PP—CHOKE SHAFT DUST SEAL RETAINING WASHER
QQ—CHOKE SHAFT DUST SEAL
RR—CHOKE WIRE CLAMP SCREW
SS—CHOKE TUBE BRACKET
TT—CHOKE TUBE BRACKET LOCK WASHER SCREW
UU—CHOKE TUBE CLAMP SCREW
VV—CHOKE TUBE CLAMP NUT
WW—BOWL COVER
XX—CHOKE VALVE PLATE
YY—CHOKE VALVE PLATE SCREW
ZZ—CHOKE SHAFT PLUG
AB—MAIN VENT TUBE GASKET
AC—BOWL COVER LOCK WASHER SCREW
AD—MAIN VENT TUBE
AE—THROTTLE LEVER
AF—CAP SCREW (GOVERNOR)

Float Level Update

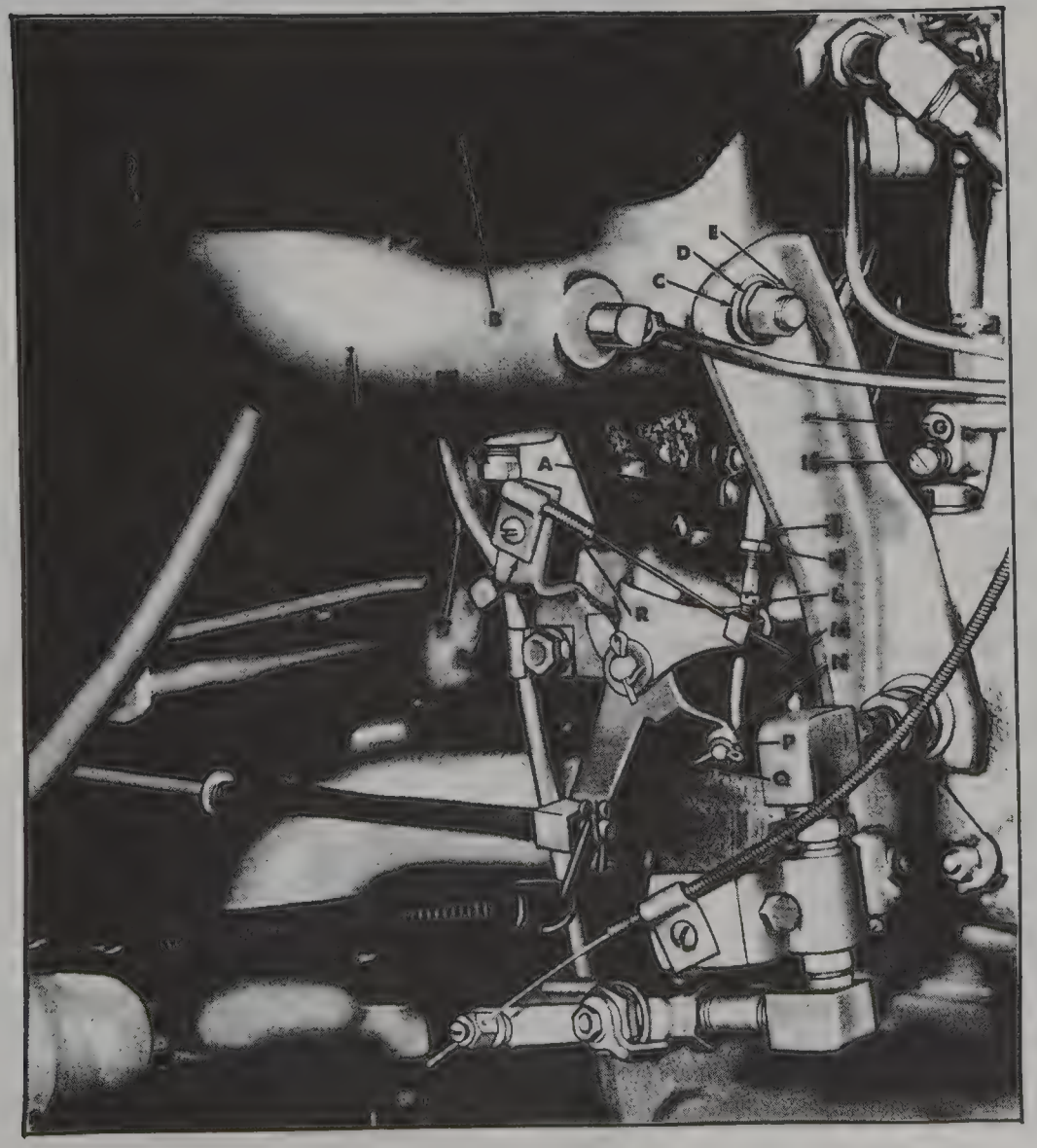
The above article on overhauling the Carter ETW1 carburetor only provides data for setting the float-level for a solid-type float needle, as neither the AFLA kit, the NAPCO kit, nor TM 1826A included data for a spring-loaded needle valve. Since then, I was able to obtain an NOS Carter overhaul kit, which included data for both types of needle valve. So if you have a spring-loaded needle valve:

Place an .050-inch feeler gauge between the lip of the float and the needle valve. Press against the lip of the float with your finger to fully compress the needle valve spring. With the spring compressed, the top of the float should be 5/64" (1.98mm) below the top surface of the carburetor body casing. Adjust by bending the float lip.



Carburetor (late type) and air cleaner elbow.

KEY	ITEM
A	AIR CLEANER ELBOW
B	CONTROL SUPPORT PLATE
C	TENSION CLIP
D	CRANKCASE VENTILATION SHUT-OFF VALVE CONTROLS
E	CHOKE CONTROL SWIVEL SCREW
F	GASKET
G	CHOKE CONTROL CLIP
H	CHOKE CONTROL
J	CHOKE CONTROL BRACKET
K	CARBURETOR
L	CYLINDER VENT LINE
M	NUTS
N	CARBURETOR MOUNTING GASKET
P	FUEL PUMP-TO-CARBURETOR FUEL LINE
Q	INTAKE MANIFOLD
R	FUEL TANK VENT LINE
S	PLAIN WASHER
T	LOCK WASHER
U	NUT
V	METERING VALVE NIPPLE
W	OIL FILLER PIPE VENT LINE
X	ELBOW FRONT SUPPORT BRACKET
Y	SHUT-OFF VALVE LEVER SWIVEL SCREW
Z	INVERTED FLARED TUBE ELBOW
AA	INVERTED FLARED TUBE ELBOW
BB	PIPE NIPPLE



Throttle Controls

KEY	ITEM
A	IDLE SPEED ADJUSTING SCREW
B	AIR CLEANER
C	PLAIN WASHER
D	LOCK WASHER
E	NUT
F	STUD
G	ELBOW FRONT SUPPORT BRACKET
H	IDLE MIXTURE SCREW
J	BALL JOINT
K	NUT
L	LEVER SWIVEL SCREW
M	BELLCRANK TO CARBURETOR ROD
N	BELLCRANK
P	PLAIN WASHER
Q	COTTER PIN
R	THROTTLE CONTROL
S	THROTTLE CONTROL CLIP
T	ELBOW SUPPORT BRACKET
U	PIPE PLUG
V	AIR CLEANER ELBOW

HOW TO ...

The ETW1 Carburetor Governor – Repair and Adjustment

Text and Photos by Alan Bowes

Whether used on a tank or a ¾-ton cargo truck, the governor on the Carter ETW1 carburetor serves the same important purpose: *improving reliability and efficiency.* By limiting engine RPM, the governor not only helps prevent pistons and connecting rods from turning to shrapnel, but it also helps keep the engine within its factory-designed horsepower and torque curves. By keeping manifold vacuum as high as possible when the engine is running at maximum RPM, it improves efficiency (especially for the more lead-footed drivers among us).

Pushing a stock engine beyond its design limits is *not* a good idea, unless you've significantly modified your engine, including balancing and strengthening all reciprocating parts.

TM 9-1826A Ordnance Maintenance – Carburetors (Carter) includes a section on governor repair and adjustment, but barely touches upon operational theory and leaves out some important details. My article summarizes most of the manual material, adds information where appropriate, updates some illustrations, and explains how to make a special adjusting tool. Space limitations preclude a discussion of governor adjustments on banked/multi-engine installations, such as used on some tanks.

How The Governor Works

The governor serves as a kind of "intermediary" between the throttle lever and the throttle valve. You communicate your power needs (via the throttle linkage) to the throttle lever, which allows the governor to open the throttle valve to the desired point. When the engine approaches a pre-set RPM limit, the governor allows the throttle valve to close as necessary to prevent overspeed, even if you still have the pedal to the metal.

So, how does the governor know how fast the engine is turning? Well, first of all, the throttle valve plate is not centered on its shaft; one side extends out farther than the other. Also, the plate is not capable of opening to a fully vertical position. This means that one side of the plate always catches more air than the other, so the air flow through the carb is always trying to *close* the throttle valve. The higher the air velocity *(or pressure differential)* across the throttle valve, the greater the closing force.

The *opening* force is supplied by a spring inside the governor, which is connected via a chain to a cam at the end of the throttle valve shaft (Figure 2 or 3). As engine speed increases, air velocity across the throttle valve rises. If it rises high enough, it begins to close the valve, which stretches the governor spring, increasing spring tension until an equilibrium point is reached and the valve won't close any further. This maintains a constant maximum RPM, even with the accelerator pressed to the floor.

In other words, pushing the accelerator to the floor allows the governor spring to open the throttle valve all the way, where it remains until the engine approaches maximum RPM, at which point the increased air velocity across the throttle valve begins to overcome the governor spring tension and starts to close the valve, thus limiting RPM.

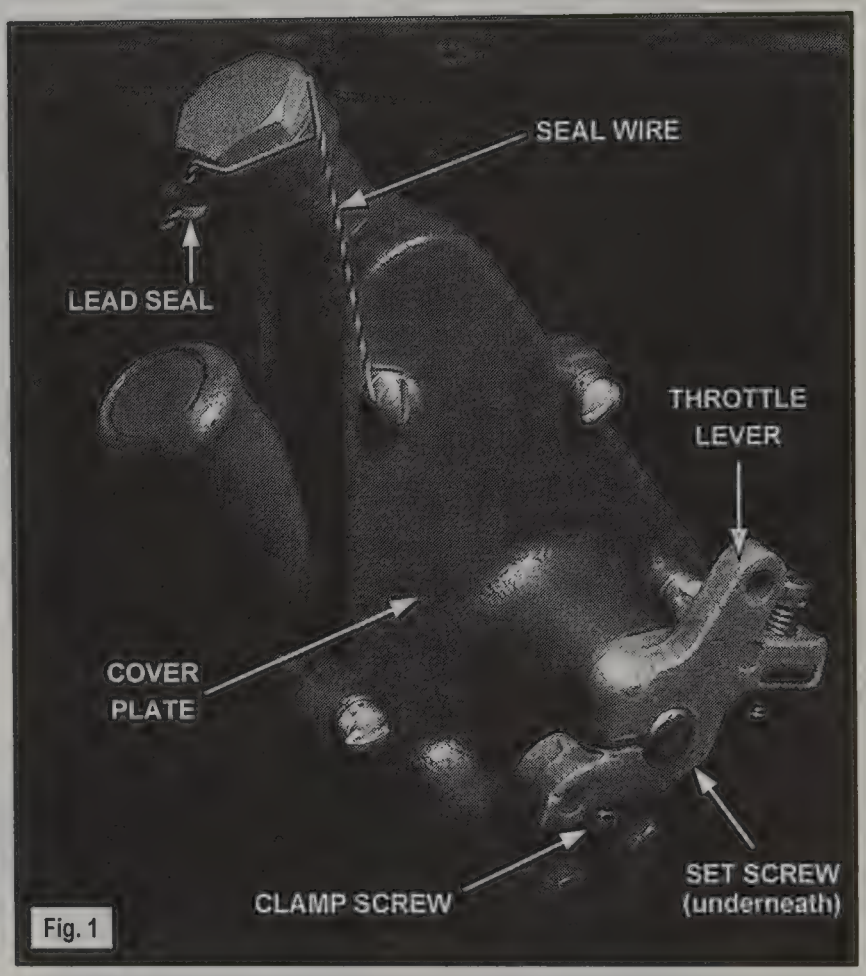


Fig. 1

If you lift your foot off the accelerator, the throttle linkage return spring (outside the carburetor) closes the throttle lever, and an arm at the end of the throttle lever shaft (inside the governor) pushes against the cam and forces the throttle valve shut.

So far, so good? Okay, let's go a step further. Let's say you're on level ground, cruising flat out, with the governor holding the engine at maximum RPM. Now you begin to descend a seven-percent grade, with the accelerator still floored. Since the engine doesn't have to work as hard, it begins to speed up and manifold vacuum starts to rise. This rise in manifold vacuum *increases* air velocity across the throttle valve, pushing it further closed (stretching the spring) until a new equilibrium point is reached. This reduces the air volume through the carburetor venturi...and the amount of fuel being fed to the engine...thus maintaining maximum RPM.

Now let's say you begin climbing a gentle grade. Since the engine has to work harder, it starts to slow down and manifold vacuum begins to drop, *reducing* the air velocity across the throttle valve. This allows the valve to open further, increasing air volume through the carburetor venturi...and the amount of fuel being fed to the engine...thus maintaining maximum RPM.

There are practical limits to the governor's ability to control engine speed. For example, if you go down a very steep hill in a higher gear, engine speed can climb well above the maximum RPM, even if the throttle valve is completely closed.

Just a few notes for the technically inclined: The spring-loaded throttle valve assembly has a relatively short natural period of oscillation and it has a tendency to flutter as air passes over it. To reduce flutter, a damping piston (plunger) is incorporated, which acts like a shock absorber.

The purpose of the cam and chain is to provide a controlled change in the mechanical advantage that the throttle valve wields against the governor spring as it changes position. The shape of the cam helps determine the governor's response curve.

The spring and cam dynamics are rather complicated. The number of active coils, the position of the end of the spring relative to the cam, and the initial spring tension all interact in a complex fashion. These factors must all be correct for the governor to respond properly to varying load conditions, correctly limit engine RPM, and react smoothly, with no surging.

A happy compromise must be reached, which brings us to the matter of adjustments. However, before adjusting the governor, it may be a good idea to disassemble, inspect, clean, and lubricate its internal workings.

Safety First

- Follow all warnings and safety instructions when using gasoline, solvents, or other flammable or toxic substances.
- Gaskets may contain asbestos, so take proper precautions.
- Disconnect the battery to prevent engine cranking or sparks.
- Keep an ABC-rated fire extinguisher nearby.
- There may be lead deposits on governor surfaces, so don't put your mouth on the parts to blow out passages.
- Dispose of waste products safely and legally.

Cleaning Tips

Refer to my article, "Overhauling the ETW1 Carburetor," in the previous issue of *Military Vehicles Magazine* for detailed tips on cleaning the carburetor and governor components.

Disassembly Tips

- *Important:* Carefully note the position and orientation of all parts before and during disassembly.
- Use a separate container for small, easily lost parts.
- Use the correct tools and screwdriver sizes. I prefer hollow-ground screwdrivers to avoid damage to screw slots.

Disassembly Procedure

1. Loosen the throttle lever clamp screw, remove the set screw, (Figure 1) and remove the throttle lever and washers. Note the relative position of the washers.
2. Remove the seal wire and governor cover plate mounting screws. Then remove the governor cover plate assembly.
3. Slide the throttle lever shaft out of the governor cover plate.
4. Check the condition of the throttle lever shaft, seal, and bushing. If the seal is hardened or cracked, it should be replaced. If there is over .020-inch clearance between the shaft and the bushing, I'd suggest a new bushing. If you can't find an NOS sintered bronze bushing, you can match up a standard-size replacement. NOS seals are still available. The old seal can be pried out with a screwdriver or a small seal removal tool. Use a drift punch to tap or press the bushing out. Press the new seal and bushing in or use a bolt, nut, and a couple of flat washers as an improvised installation tool.
5. Examine all internal governor parts for damage.
6. Carefully disconnect the chain from the cam. Note the position of the chain, in case it falls off the governor spring.

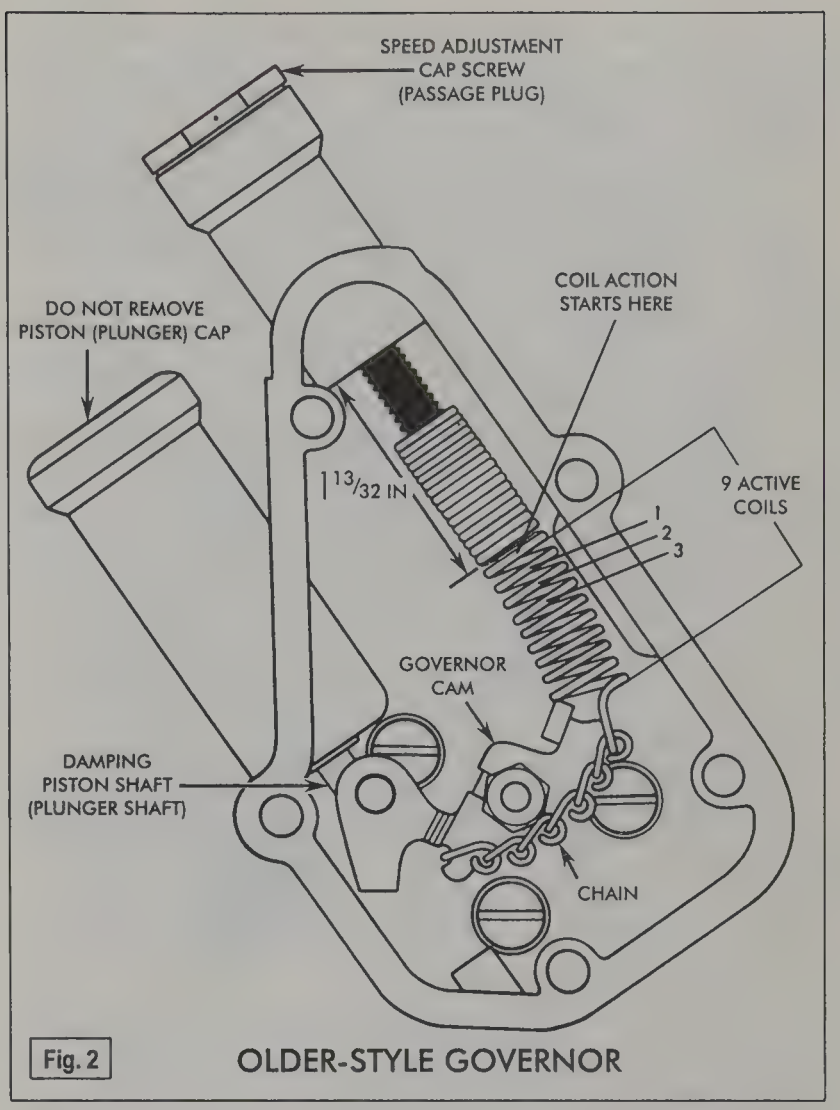


Fig. 2 OLDER-STYLE GOVERNOR

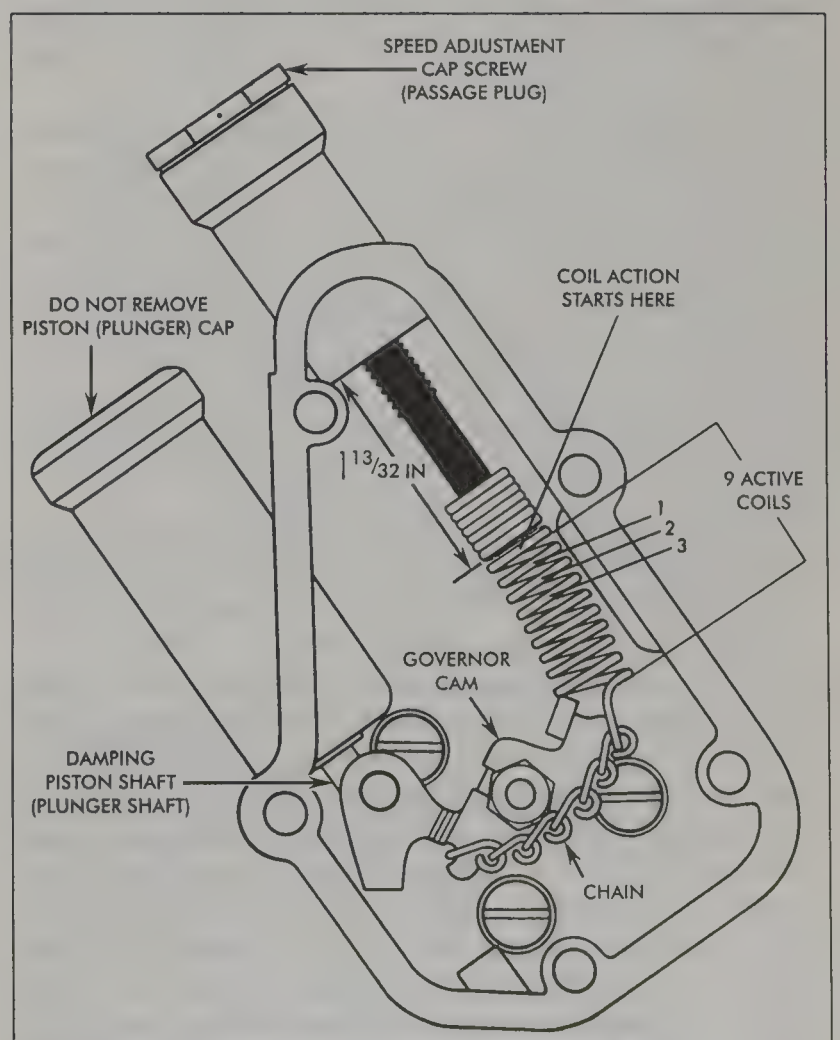


Fig. 3 NEWER-STYLE GOVERNOR

7. Rotate the throttle valve shaft to check for wear or damage.

   If the bearings feel smooth, there normally is no need to remove the cam from the throttle valve shaft or to remove the governor housing from the throttle body. Go to step 8.

   If the bearings are rough or loose, try to locate a good used throttle body assembly (by the way, a used throttle body usually comes with a governor). To remove the governor from the throttle body, follow these steps:

   a. Bend the lock washer tabs away from the cam retaining nut. Don't bend them farther than necessary, since you may have to re-use this washer.
   b. Remove the cam retaining nut and gently work the cam off the throttle valve shaft with your fingers.
   c. Remove the three countersunk governor housing mounting screws and remove the governor from the throttle body. There is probably a thin spring washer on the throttle valve shaft, so be careful not to lose it.

8. Remove the speed adjustment cap screw (passage plug).
9. Rotate the speed adjusting screw (Figure 4) one turn in each direction to check the turning resistance. If it still seems fairly snug, there is probably no reason to remove the adjusting screw or the adjusting nut.

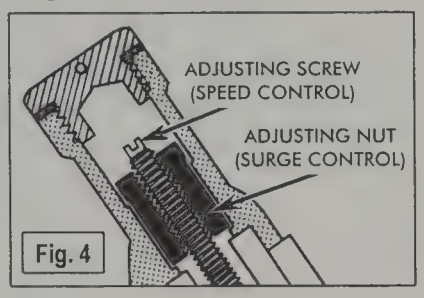


Fig. 4

   If it is still snug, go to step 10.

   If it is quite loose, it could vibrate out of adjustment. If you happen to have a rare NOS governor repair kit, you can replace the adjusting nut and screw with new ones. Otherwise, you can effect a "field" repair, consisting of a drop of low-strength or afterlock-type thread-locking fluid, applied *after* adjusting the governor. Or, you could try to find a good used governor or parts.

   Caution: DO NOT try to screw a lock nut onto the speed adjusting screw, since this screw has special compound-cut (multiple-cut) threads that an ordinary nut will destroy!

   To remove the adjusting screw, turn it clockwise down through the adjusting nut until it comes out. The spring will still be attached to the adjusting screw. To remove the adjusting nut, use a drift punch to drive the adjusting nut up out of the governor housing (don't do this unless you have a replacement nut). Be careful not to gouge the sides of the bore. To install the new adjusting nut, adjusting screw, spring, and chain, refer to steps 3 and 4 under *"Assembly"*.

   Note: There were two different governor housings, each using a different adjusting nut, adjusting screw, and spring (Figure 2 or 3). If you have a governor repair kit, it should include parts for both governor types.

10. Clean the governor parts in a non-acidic solvent. If some solvent happens to leak around the damping plunger shaft into the cylinder, it won't hurt anything, but get as much as possible out by holding the governor upright and sliding the shaft up and down until you can't see any leakage. It will eventually dry out, but compressed air may speed the drying.
11. Inspect the governor spring to make certain it is not stretched or otherwise distorted. Earlier governors had an adjusting screw with full-length threads and a 26-coil spring (Figure 2). Later governors had an adjusting screw with threads starting 7/8 inch from the fluted head that screws into the spring, and the spring had only 16 coils (Figure 3).

Assembly

1. If you have removed the governor housing from the throttle body assembly, install the spring washer on the throttle valve shaft, then install the governor housing on the throttle body. Tighten the three mounting screws and stake (peen) them in place, using a blunt chisel or screwdriver blade. This will prevent the screws from loosening (Figure 5).

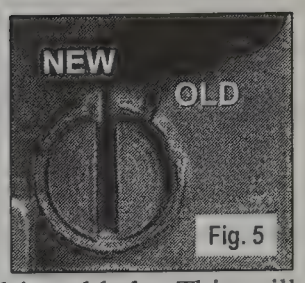


Fig. 5

2. If you have removed the cam from the throttle valve shaft, press the cam onto the end of the throttle valve shaft with your fingers. Make sure the round tab on the cam fits into the slot in the plunger shaft. DO NOT tap on the throttle valve shaft, as this can damage the ball bearings. Install the washer and lock nut on the end of the throttle valve shaft. You can use a drop of thread-locking fluid on this nut. When you tighten the lock nut, it will draw the cam tightly down onto the shaft. Bend the lock washer tabs up against the nut.
3. If you have removed the adjusting nut, tap the replacement nut down into the housing (with the slots facing up) until it bottoms. (Be sure to use the correct adjusting nut.)
4. If you have removed the adjusting screw, spring, and chain:
   a) Screw the adjusting screw into the spring until the end of the screw is even with the last coil at the lower end. (Be sure to use the correct adjusting screw (Figure 2 or 3)).
   b) Connect the end of the chain to the spring.
   c) Insert the prong that protrudes from the upper end of the spring into the slot in the governor housing.
   d) Insert the upper end of the adjusting screw in the adjusting nut, insert a screwdriver down through the hole in the adjusting nut, and turn the adjusting screw counterclockwise up through the adjusting nut.
5. Turn the adjusting screw as necessary to produce nine active (free) coils (Figure 2 or 3). (This is a rough setting only! The final adjustment is made with the engine running.)
6. The distance from the end of the adjusting screw inside the spring to the cylindrical boss in the housing (Figure 2 or 3) should be 1–13/32 inches (3.57 cm). To adjust this distance, you can use an official (and hard-to-find) adjusting nut wrench (41-W-3734) or make a home-made tool.

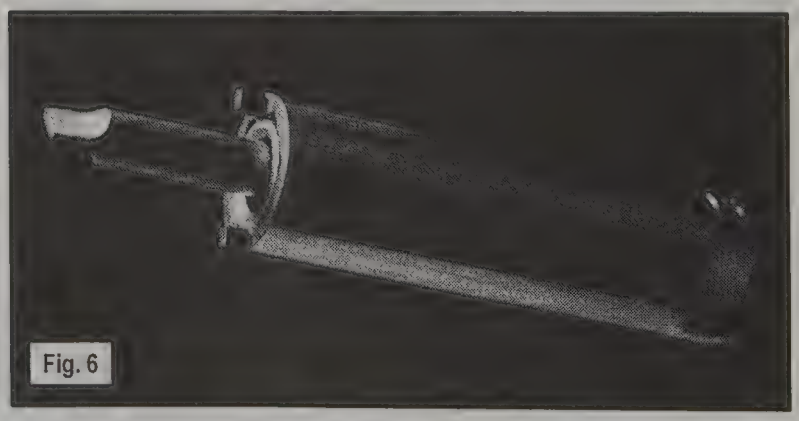


Fig. 6

I made a tool (Figure 6) from a 3/8-inch, 1/4-inch-drive socket. I filed one end to leave two prongs that fit into the slots in the adjusting nut. I filed the other end of the socket so that a 3/8-inch open-end wrench can turn the tool. If you want to get fancy, you can epoxy in one or two brass bushings as guides for centering the screwdriver over the adjusting screw. As an optional finishing touch, I reworked an old screwdriver to make a hollow-ground tip.

7. Hold the adjusting screw stationary with a screwdriver and turn the adjusting nut with the special tool (Figure 7), as required to produce the 1–13/32 inches (3.57 cm) between the end of the screw and the cylindrical boss (Figure 2 or 3). This moves the adjusting screw and spring as a unit, without changing the number of active coils.

8. Connect the end of the chain to the cam (Figure 2 or 3). This is easier if you hold the throttle valve all the way open.
9. Open and close the throttle valve, making sure all governor parts engage each other correctly and don't bind anywhere.

   Note: It is not uncommon for the throttle valve plate to stick a little in the throttle body throat when placed in the closed position. After assembly, the idle speed screw should prevent the plate from contacting the side of the throat.
10. Let a drop of light oil run down the throttle valve shaft into each of its bearings. You could also oil the damping plunger.

    Note: There is some difference of opinion as to whether you should oil the damping plunger shaft and bushing. The manual says NOT to oil it, but it's my opinion that a porous sintered bronze bushing should have a small amount of light lubricant in it, and a solvent cleaning tends to dry it out. I would use a drop or two of very light synthetic oil or electric motor oil. It's up to you. But in any case, DO NOT use heavy oil, grease, or any lubricant that can leave a sticky film (including some popular spray-on lubes).
11. Put a few drops of oil between the throttle lever shaft seal and the bronze bushing in the governor cover plate.
12. Slide the throttle lever shaft into the governor cover plate.
13. Slide the throttle lever and washers onto the shaft. Put a tiny dab of removable-type thread-locking fluid on the set screw and screw it in (half-tight only) to position the lever. Now tighten the clamp screw and finish tightening the set screw.
14. Hold the throttle lever in the wide-open position and place the governor cover plate and gasket on the governor housing. Install the cover plate mounting screws. At least one of these screws should have a drilled head; this screw should be installed at the top of the cover plate to accommodate the seal wire (installed after adjusting the governor).

Adjustments

There are two adjustments that interact with each other:

- The adjusting screw (speed control).
- The adjusting nut (surge control).

Turning the adjusting screw (while holding the adjusting nut stationary) changes the number of active coils. It also moves the position of the end of the spring, although to a lesser degree.

Turning the adjusting nut (while holding the adjusting screw stationary) changes the position of the end of the spring and its initial tension, but it does not change the number of active coils.

Adjusting Procedure

As mentioned, the settings in Figure 2 or 3 are only starting points. Final adjustments must be made with the carburetor installed and the engine running.

1. Remove the speed adjustment cap screw and gasket.
2. Connect a tachometer and vacuum gauge to the engine.
3. Run the engine for a few minutes to warm it up.
4. Set the idle speed and mixture to obtain at least 17 inches of manifold vacuum at idle (allow some reduction for altitude).
5. Apply full throttle. When the governor levels off the engine speed at maximum RPM, manifold vacuum should be about 16 inches (or one inch less than idle). Depending on the engine, maximum RPM should be between 3,000 and 3,400 RPM, with older engines tending towards the lower end. Consult your technical manuals for specific RPM limits.

   Caution: Be careful not to exceed maximum engine speed when you apply full throttle. Since the governor is only roughly adjusted at this point, it is possible to overspeed the engine and damage it.
6. To change maximum speed, hold the adjusting nut stationary with the special tool (Figure 7) and turn the adjusting screw clockwise with a screwdriver to decrease maximum speed, or counterclockwise to increase it. Apply full throttle after each adjustment increment and repeat this procedure until the engine speed levels off at the correct RPM.
7. *If there is any noticeable surge* (repeated rise and fall of engine speed) at full throttle, turn the governor adjusting nut clockwise ¼ turn with the special tool while holding the adjusting screw stationary with a screwdriver. After each ¼-turn increment, readjust the maximum engine speed as explained in step 6. Repeat this procedure until the surge just barely disappears and make the final speed adjustment.

   If there is no surge at all at full throttle (or if response is too slow/flat), turn the governor adjusting nut counterclockwise ¼ turn with the special tool while holding the adjusting screw stationary with a screwdriver. After each ¼-turn increment, readjust the maximum engine speed as explained in step 6. Repeat this procedure until some surge just becomes noticeable at full throttle, then turn the adjusting nut back ¼ turn clockwise and make the final engine speed adjustment.

   The engine operates most efficiently when it is adjusted to the point where surge is barely eliminated at full throttle.
8. Install the speed adjustment cap screw (passage plug) and gasket, then thread a piece of galvanized or stainless steel wire through the holes in the cap screw and the upper mounting screw(s) of the governor cover plate (Figure 1).
9. Slide a new lead seal over the seal wire and crimp it.

Comments or Questions?

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Some Sources

Adirondack Dodge Parts — 800-932-8020
Antelope Valley Equipment — 800-521-8518
Camo, Inc. — 717-476-9333
Thomas W. Murray — 302-736-1790
Surplus City Jeep Parts — 800-353-3772
Trader John's Outpost — 847-741-3388
Vermont Commercial Salvage — 802-864-4762
Vintage Power Wagons — 515-472-4665

HOW TO...

Rebuilding the M37 Distributor

Text and Photos by Alan Bowes

Distributors in older vehicles have a bit of a reputation for being failure prone, but with proper attention they are very reliable devices. Points-type distributors contain delicate parts that cannot tolerate dirt, wear, corrosion, or incorrect adjustment. After years of neglect, a distributor will be in a sorry state that will make your motoring life miserable. This article shows you how to rejuvenate your tired distributor and keep it well for many years to come. Although the M37 distributor is featured here, most of this information should be useful for distributors on other M-Series vehicles.

Fig. 1

Repair, Rebuild, or Replace?

Depending on a distributor's condition, it may require a complete overhaul or just minimal repairs and adjustments. The deciding factor is typically the condition of the shaft, bushings, and thrust washers; replacing these parts requires complete disassembly. Other parts, however, such as the points, rotor, cap, capacitor, cam, coil, wiring, breaker plate clips, and advance weight springs, can be replaced or adjusted without having to do a complete tear-down and overhaul.

TM 9-8030, Organization and Operational Maintenance, provides only removal, replacement, and tune-up information. This article fills in the gap by explaining how to do a complete overhaul. Read the entire article, then decide if you want to do a full rebuild. If not, you can skip the steps that don't apply.

Removing the Distributor

1. Park the vehicle on level ground, set the brake, block the wheels, and turn off the ignition.
2. Clean the distributor and the adjacent area on the engine.
3. Note the location and order of the spark plug cables on the distributor, and disconnect the cables from the distributor.
4. Disconnect the +24V lead from the distributor receptacle.
5. With the transmission in neutral, turn the engine over by hand until the timing indicator points to the DC (dead center) mark on the crankshaft pulley. (This must be on the compression stroke. Remove the #1 spark plug, put your finger in the hole, and check for pressure as the piston rises.)
6. Disconnect the vent lines. These lines circulate air through the distributor for cooling, drying, ozone reduction, etc.
7. Remove the distributor hold-down bolt and washer.
8. Slide the distributor straight out of the engine. Use some penetrating oil if it resists. Don't force it or hammer it.
9. Carefully clean around the distributor hole in the block, and stuff a clean rag into the hole to keep debris out.

Disassembly and Inspection Procedure

To make your job easier, I reworked the parts diagram from the parts manual (Figure 2), correcting some mistakes and omissions and replacing the numbered callouts with labels. Refer to Figure 2 for the parts named in this article, unless referred specifically to a different figure.

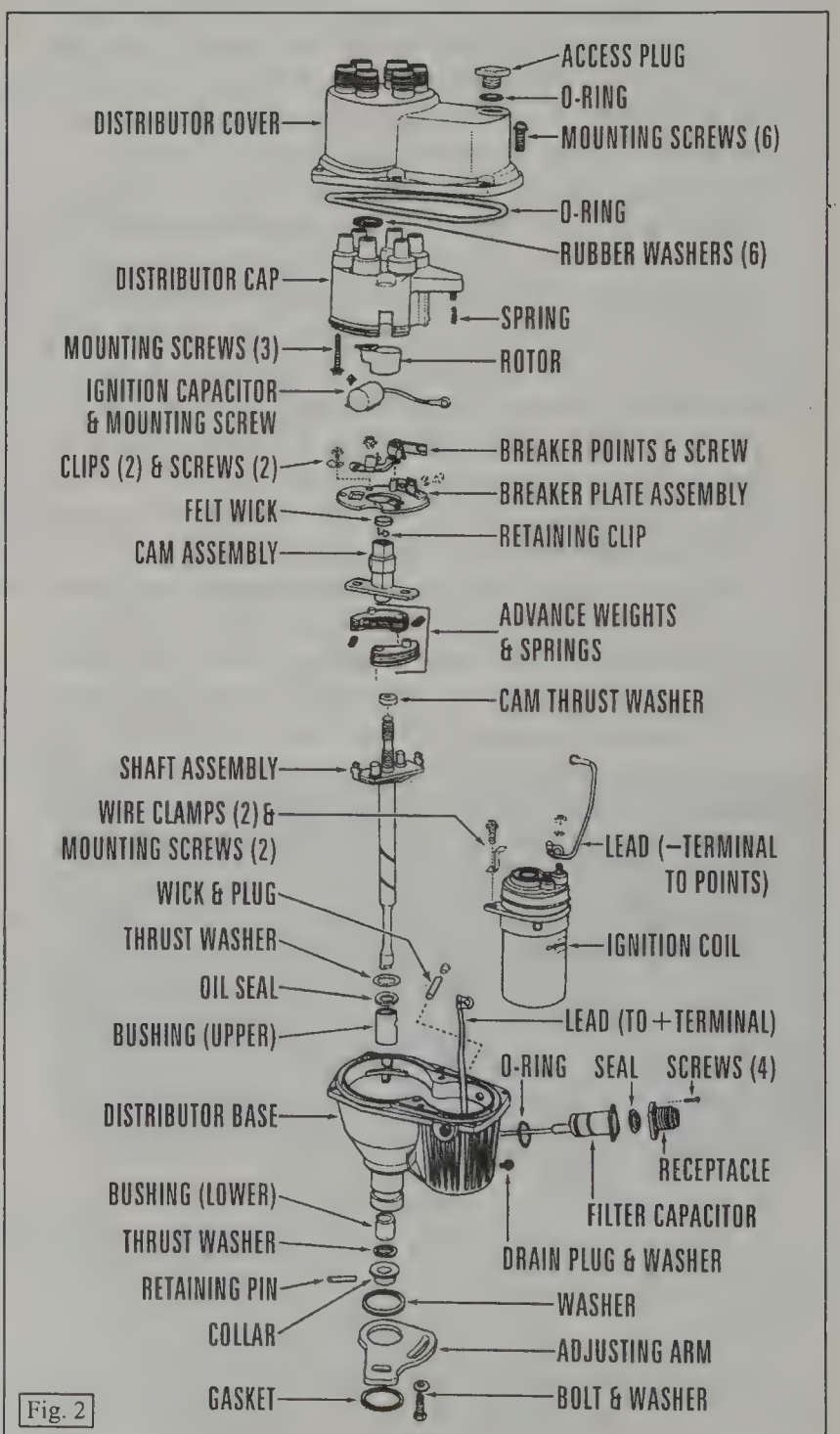


Fig. 2

1. Remove the six mounting screws that fasten the distributor cover to the distributor base, remove the cover, and remove the large o-ring from its groove in the distributor base.
2. Remove the three screws that fasten the distributor cap to the cover, and remove the cap from the cover (Figure 23). Don't lose the six rubber washers that seal the cap to the cover.
3. Pull the rotor straight up off the cam assembly.
4. Remove the breaker points from the breaker plate by loosening (or removing) the nut or screw that holds the spring on the terminal post, removing the mounting screw and lock washer, and lifting the points off the breaker plate.
5. Remove the ignition capacitor mounting screw and lock washer, and lift the capacitor off the breaker plate.
6. Remove the nuts and washers that fasten the leads to the ignition coil, and lift off the leads.
7. Remove the two coil mounting screws, noting the placement of the wire clamps and washers, then remove the coil. On some coils, there may be a washer under each mounting tab.
8. Remove the four filter capacitor mounting screws, and remove the capacitor and receptacle assembly.
9. Remove the felt wick from the top of the cam assembly.
10. Remove the cam retaining clip. This tiny part is easily lost. Spread the clip legs a bit with a small screwdriver and lift out the clip with a needle-nose pliers (Figure 3). A breaker plate parts kit is available, which contains a new clip.

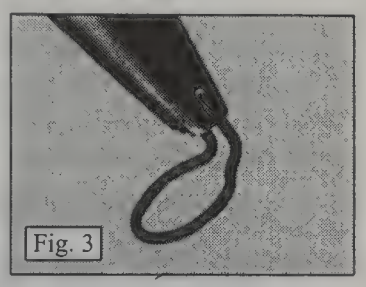


Fig. 3

11. Remove the two breaker plate mounting clips (Figure 20) and screws, then lift out the breaker plate.
    NOTE: After removing the breaker plate, the cam assembly and centrifugal advance weights can fall out if you turn the distributor upside down. For now, leave these parts in place and hold onto them whenever you invert the distributor.
12. Check the side play between the distributor cam assembly and the distributor base. If possible, measure it with a dial gauge. A small amount of play is normal, but I'd estimate that anything over about .004" is excessive and will cause inconsistent point gap, affecting timing and dwell.
13. *IMPORTANT: The cam assembly and the distributor shaft are both non-symmetrical. The cam assembly has a flat area on one side to index the rotor, and the drive tab at the end of the shaft is offset. If you look down on the distributor, with the flat area on the right, the drive tab (dotted line) should be offset above center and angle upward, as shown in the-simplified diagram in Figure 16. Make a note of the position of the cam assembly relative to the distributor shaft.*
    Slide the cam assembly off of the distributor shaft, and store it where it won't be nicked or damaged.
14. Remove the cam thrust washer from the upper part of the distributor shaft (Figure 15). Put it where it won't be lost.
    NOTE: This part is often lost because it is not shown on the original parts diagrams (I've added it to Figure 2).
15. Check the side play between the upper part of the distributor shaft and the distributor base. Subtract it from the reading you obtained in step 12. If most of the play remains, then the play is due mostly to wear in the bronze bushings. If most of the play is gone, the wear is due mostly to wear in the upper part of the distributor shaft and the cam assembly bore.
    NOTE: You can also check the shaft end play (.003" to .010" is normal), but it's not as critical as side play. Excessive end play is caused by worn thrust washers and mating surfaces.
16. Typically, the decision to do a complete rebuild depends on the amount of play and which parts are worn. It's up to you.
    If you DO NOT want to do a complete rebuild, go to "Cleaning and Refinishing."
    To do a complete rebuild, continue with the next steps.
17. Clamp the bottom of the distributor base in a soft-jawed vise (leather or dead-soft aluminum inserts). Don't overtighten.
18. Punch out the roll pin that retains the collar on the distributor shaft.
    NOTE: Some distributors use a solid-steel pin instead of a roll pin. If so, the end of the pin may be peened over, and you must file the end of the pin flush with the collar before punching it through.
19. Remove the collar and lower thrust washer from the shaft, carefully remove any burrs around the pin hole, and slide the shaft out of the distributor. Don't lose the upper thrust washer or allow the centrifugal advance weights to fall off. Place the shaft where it won't be nicked or damaged.
20. Remove the upper thrust bearing oiling plug and remove the felt oil wick (Figure 11).
21. Remove the old bushings as follows:
    a. Press the bushings and seal up and out of the distributor. If you don't have a hydraulic press, you can use a bearing installation tool and tap the bearings out. Or, just make a simple tool: Drill a 3/8" hole in a steel plate, place the plate across the top of the distributor base, insert a 5/16" threaded rod through the hole, attach a nut and flat washer at each end, and tighten the nuts. The washer's outside diameter must be under 5/8". This tool can also be used to install the new bushings and seal.
    NOTE: The bushings are standard-size sintered bronze bushings (1/2" ID x 5/8" OD x 1" long). These are available from bearing suppliers OR as part of an NOS kit that includes new thrust washers and a new oil wick. In either case, you will have to file a slot into one of the bushings, and drill a hole in the other. Note that the NOS kit also includes a new seal, but it may be hardened beyond use, so plan on buying a new seal (CR-4912 or equivalent) at a bearing supply house.
22. For now, leave the advance weights and springs in place on the distributor shaft. Go to "Cleaning and Refinishing."

Cleaning and Refinishing

***WARNING**: Follow all of the manufacturer's recommendations and precautions when using flammable or toxic materials.*

1. Remove these parts in preparation for cleaning and painting:
    - The two brass vent-tube elbows.
    - The small drain plug in the distributor base.
    - The upper bushing oiling plug and oil wick.
    - The coil terminal access plug and o-ring.
    - The distributor adjusting arm.
2. Strip the parts to clean, bare metal for best paint adhesion. Carburetor cleaner is a good solvent for many, but not all of the parts. It should remove grease, dirt, and paint. Some carburetor cleaners contain acid, so don't leave parts in too long (check the instructions). Stubborn paint may require longer soaking or other solvents to remove it.

NOTES: Many parts can be damaged by bead blasting, so I'd avoid it. DO NOT submerge the distributor base in solvents unless it has been completely disassembled, since solvent may damage the oil seal or soak into the sintered bronze bushings. DO NOT submerge capacitors in solvents.

3. Mask the brass spark plug cable threads on the distributor cover, and apply a thin coat of zinc oxide primer/sealer to the cover. This primer adheres very well to clean, bare metal and is available in spray cans from autobody or aircraft suppliers. Apply a thin second coat of primer if desired.
4. Mask the upper and lower thrust bearing mating surfaces on the distributor base. Also mask the data plate and the round steel part of the distributor base that slides into the engine block. Apply one or two thin coats of zinc oxide primer.
5. After the primer has dried, apply a couple of light coats of paint (olive drab or satin black; you decide) to the distributor cover and a couple of coats to the distributor base. Let the paint cure before working on these parts.
6. A nice touch is to install new fasteners. The most visible ones are the six cover-mounting screws (10-32 x 3/4 fillister head) and the four filter-mounting screws (6-32 x 1/2 fillister head). These are available from aircraft supply or fastener houses. You should also install new lock washers; most are internal lock washers, but regular lock washers will work. I suggest using hollow-ground screwdrivers of the correct size to avoid damaging any screw slots.
7. Clean the coil separately with a brush and solvent. Check the top of the coil for carbon tracks, which can short out the high voltage. Mask the top of the coil and spray the coil body with zinc oxide primer, followed by a coat of paint.
8. Examine the distributor shaft where it contacts the bushings, being careful not to let the advance weights fall off of their pivots. It should be smooth with no nicks. Light surface rust can often be removed by rotating the shaft in a fine-grit (gray) ScotchBrite™ pad. Do not make spiral or lengthwise patterns, since these can wear out the bushings more quickly. If the rust doesn't come off easily, replace the shaft.
9. Clean the shaft with solvent, then carefully lift the advance weights off of their pivots (leave the springs attached), and clean the inside of the pivot holes with a small brush and solvent. There are two small pockets in each pivot hole (Figure 13) that must be cleaned out. These are designed to hold grease to keep the pivots lubricated.
10. Clean the distributor cam assembly with a brush and solvent. Don't use any abrasives, unless there is some very light surface rust on the cam, in which case you can polish it by rotating it in a fine (gray) ScotchBrite pad. If it doesn't clean up easily, replace it with a good used or NOS cam assembly. A damaged cam surface will quickly wear out the rubbing block on the breaker points and will make timing erratic.
11. Clean the breaker plate with a brush and solvent.
    NOTE: If the breaker plate is rusty, I'd recommend replacing it with a good used or NOS plate. Or you can give it a light bead blasting to remove the rust, but mask off the brass post to avoid damaging it. Be careful not to undermine the insulation that separates the terminal post from the breaker plate. Don't use acid to remove rust, since it can seep under the terminal post insulation, cause corrosion, and conduct electricity. After bead blasting, you can mask all electrical contact areas (brass post, upper area of the terminal post, lower edge of the plate where it contacts the distributor base) and apply a coat of clear acrylic finish. DO NOT use metallic paint, which can short out the insulator.

Assembly Procedure

1. *If you did not remove the bushings,* skip to step 2.
   If you removed the bushings, prepare and install the replacement bushings as follows:
   a. Use a round file to cut an oiling slot into the upper bushing (Figure 4). Make sure the size and location of the slot match the original bushing (Figure 5). Get some extra bushings in case you make a mistake.

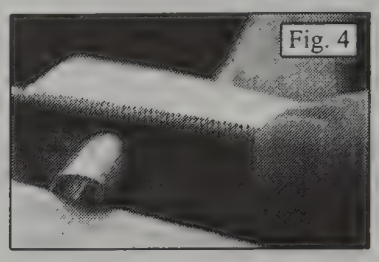


Fig. 4

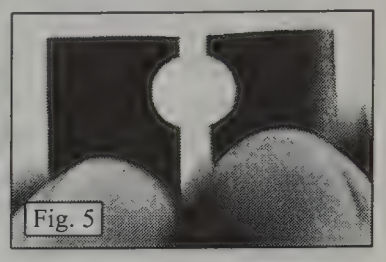


Fig. 5

   b. Align the oiling slot of the upper bushing with the oil wick passage in the distributor base (Figure 6), then press it in, or use the improvised tool described earlier. DO NOT pound on the soft bushing. Press it in to the point where the oiling slot lines up with the oil wick passage, but the bushing should not protrude up into the seal area. It should appear as in Figure 7.

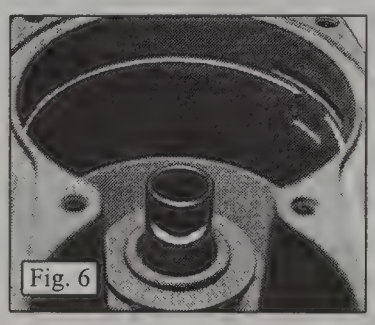


Fig. 6

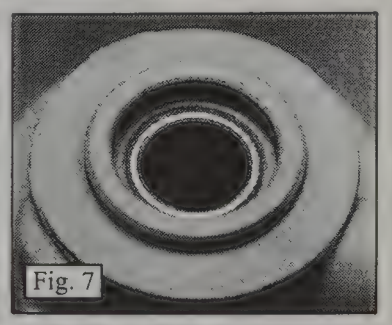


Fig. 7

   c. Press in the lower bushing. It should be recessed just a bit below the end of the distributor base (Figure 8). This prevents interference with the thrust washer and also provides a small oil "reservoir" for the washer.

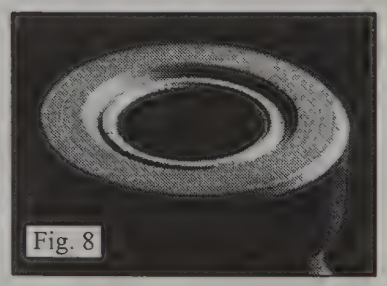


Fig. 8

   d. Drill a new oil hole in the lower bushing with a drill of the same size as the original hole (Figure 9), and clean out any shavings or debris.
   e. Press the new oil seal in, making sure that it is facing in the correct direction. It should be recessed just slightly below the surrounding steel thrust surface (Figure 10). This recess will hold a bit of grease for the thrust washer.

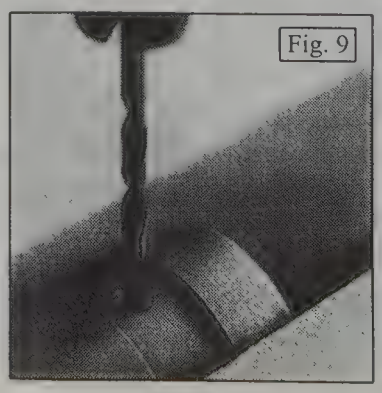


Fig. 9

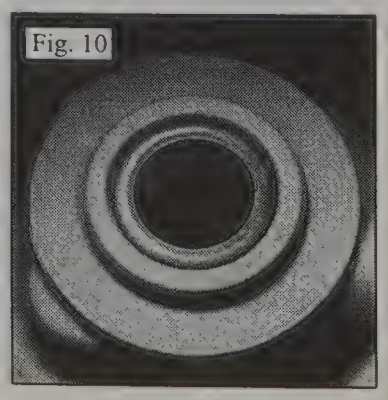


Fig. 10

2. Soak the bushing oil wick in motor oil, and slide it into the wick passage (Figure 11). The NOS bushing kit includes a new oil wick, but you can re-use the old wick just by turning it so that an unworn area faces the shaft.

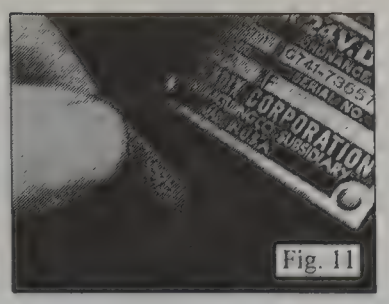


Fig. 11

3. Install the upper bushing oiling plug.
   NOTE: I've added a brass elbow (Figure 1) to create a small oil reservoir, which might keep the bushings lubricated longer. I say "might" because I'm not sure how fast the extra oil will soak through and drain out, but it still makes it easier to saturate the oil wick during a routine lubrication.
4. *If you have not removed the distributor shaft,* skip to step 7.
   If you have removed the distributor shaft, continue with **a**.
   a. Apply a 1/8" layer of high-temp grease to each side of the upper thrust washer and slide it onto the shaft.
   b. Oil the bushings and shaft, and slide the shaft down through the seal and bushings in the distributor base.
   c. Slide the lower thrust washer onto the shaft.
   d. Slide the thrust bearing collar onto the shaft.
      If you are installing a new shaft, continue with step **e**.
      If you are re-using the original shaft, skip to step **k**.
   e. *NOTE: NOS shafts are not drilled for a collar. You will have to drill through the collar and the shaft at the same time to make sure the holes line up.*
      Push the collar up against the distributor base as you push the shaft in the opposite direction down through the distributor base. While keeping this assembly squeezed tightly together, rotate the shaft several times to work the grease out from under the thrust washer to avoid a false end-play reading. Insert a .001" or .002" feeler gauge between the thrust washer and the distributor base to create a tiny bit of clearance. As the thrust surfaces break in, more end play is soon created (.003"–.010" is normal).
   f. Rotate the collar so that the undrilled space between the old holes is facing up, then clamp the shaft in a soft-jawed drill-press vise, in a manner that will keep the assembly squeezed tightly together and prevent the collar from sliding back down. Make sure the shaft is level.
   g. Make sure there is no end play with the feeler gauge inserted. Don't remove the gauge yet.
   h. *NOTE: DO NOT try to re-use the old holes in the collar when drilling a new shaft, since it is highly unlikely that the drill bit will exit in exactly the correct location.*
      Center-punch the collar, then drill through the collar and shaft with a 1/8" bit (Figure 12). Make sure that you drill straight down through the center of the shaft.

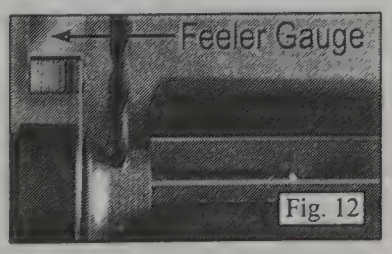


Fig. 12

   i. Slide the collar off and clean off any shavings.
      NOTE: If you need to remove the distributor shaft for any reason, use a jeweler's file to remove any burrs from the new hole before sliding it up through the bushings.
   j. Reinstall the lower thrust washer and collar, making sure that the holes line up perfectly at both ends (don't install it 180 degrees off, and don't use the old holes).
   k. Clamp the shaft in a soft-jawed vise and install a new pin to secure the collar to the shaft. You can use either a 1/8 x 3/4 roll pin or a piece of 1/8-inch mild steel rod.
      If you use a roll pin, make sure that it is a very snug fit as you tap it down through the hole. You can "stake" the edges of the collar hole around the pin if you want to add a bit of insurance against the pin working out. An automatic punch works well for this. You can also use a small drop of thread-locking fluid to provide a little extra security, but don't let any fluid seep into the bushing.
      If you use a piece of 1/8-inch mild steel rod, cut its length so that when you insert it in the hole, it sticks out about 1/16" to 3/32" on each side of the collar. It should be a close fit, but not necessarily a press fit. Then squeeze the pin end-to-end in a large vise to upset (mushroom) each end. This prevents the pin from coming out and makes the rod expand in thickness to produce a snug fit in the hole. Alternatively, you can peen the ends with a hammer and anvil or use a rivet gun and bucking bar to upset the ends and expand the rod.
5. Carefully remove the advance weights and springs from the old distributor shaft. Be very careful not to stretch the ends of the springs. Leave them attached to the advance weights. If the springs are damaged, replace them with used or NOS springs. They must be correct for this distributor and engine.
6. Carefully slide the ends of the advance springs over the spring posts on the new distributor shaft.
7. Fill the little grease pockets in the advance weight pivot holes with high-temperature grease (Figure 13), and slide the weights down over the pivots (Figure 14).

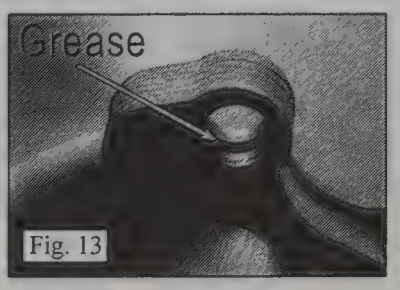


Fig. 13

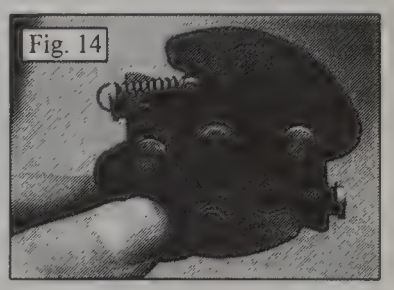


Fig. 14

8. Fill the spiral grooves in the upper distributor shaft with high-temperature grease.
9. Slide the cam thrust washer down over the distributor shaft, with the flat side up (Figure 15). The tapered area on the bottom side of the washer will fill with grease as you slide it down the greased shaft.

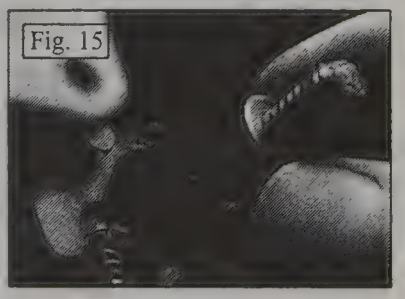


Fig. 15

10. Slide the cam assembly onto the distributor shaft and position the advance weights so that the pins on top of the weights slip into the slots in the cam plate (Figure 17). Put a little high-temperature grease in these slots.
    IMPORTANT: DO NOT install the cam 180° off. As mentioned, the cam assembly and the distributor shaft are both non-symmetrical. The cam assembly has a flat area on one side to index the rotor, and the drive tab at the end of the shaft is offset. When you look down on the distributor, with the flat area on the right, the drive tab (dotted line) should be offset above center and angle upward, as in Figure 16. Check the notes you made earlier.

Fig. 16

11. Install the cam retainer clip in the groove on top of the distributor shaft. I use two small flat-blade screwdrivers to push down on each side of the clip (be careful not to launch it into space). Before installing a used clip, you can bend it a little to make it fit more snugly.
12. Check the adjustment of the advance weight springs. With the weights in toward the shaft all the way, the lighter spring should have a bit of tension on it, but the heavier spring should have some play in it. I haven't found a spec on this, but having measured it on a couple of NOS distributors, here's how I'd set it: Hold the distributor shaft stationary with one hand, and gently rotate the cam clockwise until the slack in the heavier spring is JUST taken up and you start to feel a little extra tension. At this point, the pin in the advance weight should be at the mid point of the slot in the cam assembly (Figure 17). The idea is that the lighter spring allows the spark to advance rather quickly when you first speed up the engine, but as speed increases, the heavier spring starts to exert its tension, which slows down the advance rate. Generally speaking, you won't have to adjust the lighter spring. To adjust the heavy spring, carefully bend its spring post in or out as needed, and recheck it after each adjustment. Be careful not to damage the end of the spring. A small flat-blade screwdriver may be handy for bending the post.

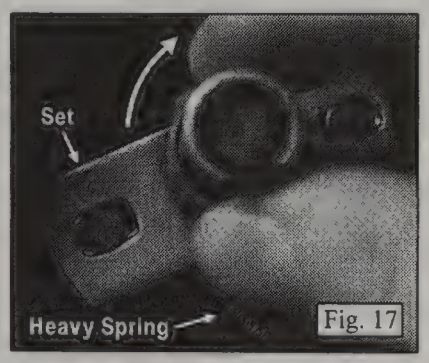


Fig. 17

13. Make sure there is an adequate amount of bend on the two breaker plate retaining clips (Figure 18). If these are too flat, they won't secure the breaker plate, allowing it to slide around and change the point gap. You may be able to bend them a bit, but they may break when you do this. It's better to order an NOS breaker plate parts kit (2920-606-9378), and install new ones.
NOTE: These are spring-steel clips and cannot be replaced with normal-temper steel, so don't lose them.

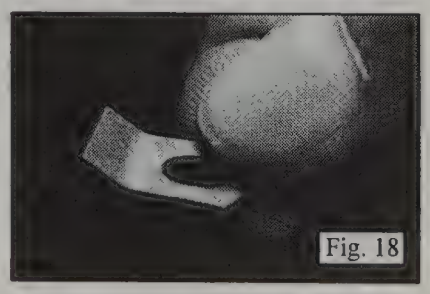


Fig. 18

14. Insert the breaker plate in the distributor. Its downward-facing tab fits into a shallow groove in the distributor base.
15. Install the two mounting clips and screws. Rotate the clips into the slots in the side of the distributor base before tightening the mounting screws.
16. Install the new capacitor on the breaker plate.
NOTE: Capacitors usually use a wraparound or clip-on bracket, which might not hold the capacitor in exactly the right position. You may have to bend the bracket a bit to prevent interference with the distributor cap or cam. Set the distributor cap on the distributor base (Figure 19), and look through the opening (see arrow) to make sure it's not pressing against the capacitor, which could force the capacitor into the cam, causing major damage. Remove the cap and make sure that there is at least 1/16" of clearance between the cam and the capacitor.

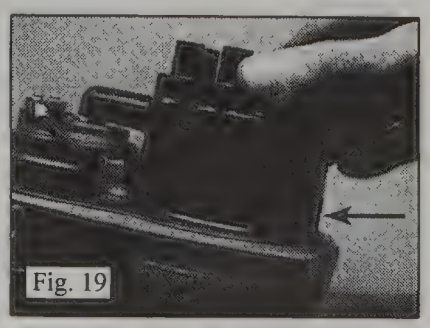


Fig. 19

17. Install the new breaker points (NAPA Echlin CS-725A) on the breaker plate. Make sure the spring is completely level. Snug up the mounting screw, but don't fully tighten it yet.
18. Clean any corrosion off the contact pin on the filter/receptable, and install the filter/receptacle assembly in the distributor base. Use a new rubber o-ring with a film of grease on it. Also put a bit of grease on the outer rubber seal.
19. Install the leads from the capacitor and the negative coil terminal on the breaker plate terminal post (Figure 20), and tighten the terminal post screw.
NOTE: I use a thin flat washer against the connectors to reduce the tendency to twist them when tightening the screw.
20. Position the cam to maximize the point gap. Rotate the adjusting screw (Figure 20) to adjust the gap to .020". Tighten the breaker points mounting screw, and recheck the gap, which may change when you tighten the mounting screw. If necessary, loosen the mounting screw, and repeat this step.

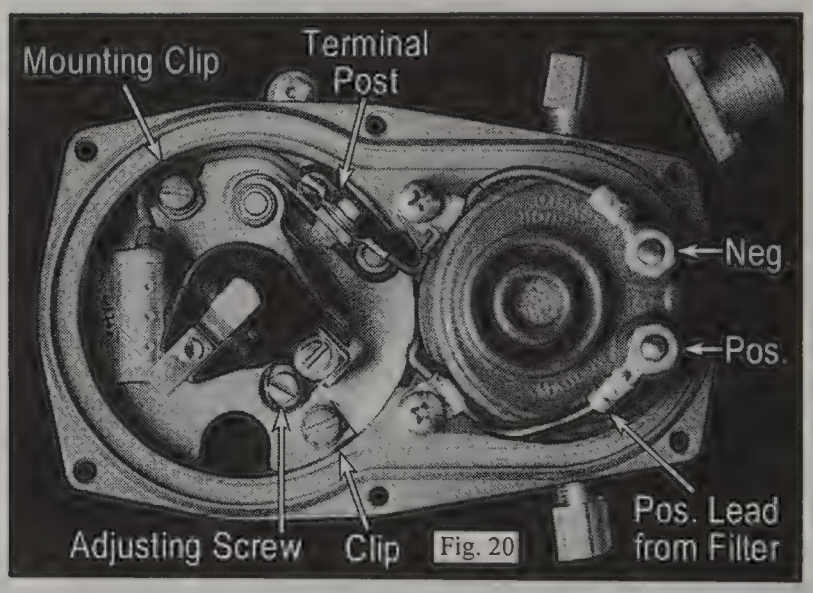


Fig. 20

21. Put a tiny dab of high-temperature grease on the rubbing block of the points, on the side of the rubbing block towards which the cam rotates (the cam rotates clockwise).
22. Slide the coil down into the distributor, and install the washers, wire clamps, and mounting screws (Figures 2 and 20). You might want to put a thin flat washer under each tab on the coil mounting bracket if there is more than about .030" between the tab and the distributor base. Leave these mounting screws loose for the moment.
23. Route the leads from the filter capacitor and the breaker points up the side of the coil and under the wire clamps, as shown in Figure 20. The filter lead goes to the positive coil terminal. Install the terminal washers and nuts, but don't overtighten them (the terminals are brass). You can wrap a piece of electrical tape around the leads where they pass under the wire clamps to protect them from chafing.
24. Tighten the two coil mounting screws (Figure 20). The original screws are straight-slot fillister-head 10-32 x 3/4".
25. Set the distributor cap temporarily on the distributor base again to make sure that it does not conflict with the two coil wires or the capacitor. Make any necessary adjustments.
26. Insert the small oil felt into the top of the cam assembly, and put a few drops of motor oil on it.

27. Install the distributor rotor on the cam assembly. Make sure that the rotor is fully seated.
28. Use a small file to remove any excess mold flashing from any areas on the distributor cap that contact the distributor cover or the distributor base (Figure 21). This material can prevent the cap from going on straight.

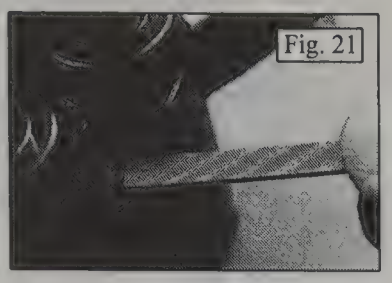


Fig. 21

29. Install the six rubber seals around the towers on the distributor cap (Figure 22). These are still available as NOS parts. The ones I've seen are still quite soft after 46 years on the shelf. You can usually re-use the old ones if you want. Some people have successfully used 3/32"-thick o-rings. Put a film of grease on the washers to improve their seal and preserve them.

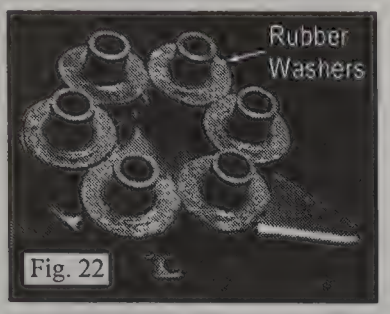


Fig. 22

30. Install the distributor cap in the distributor cover (Figure 23), and evenly tighten the three cap mounting screws, but don't overtighten them. *NOTE: Make sure the small spring is still connected to the high voltage terminal on the side of the distributor cap.*

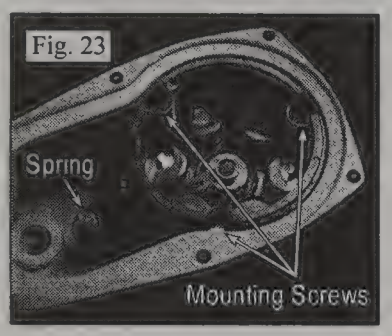


Fig. 23

31. Install all of the small fittings, including the vent elbows, drain plug, and the coil terminal inspection cap and o-ring.
32. Re-inspect the point gap, wires, connectors, etc.
33. Install the large washer and the distributor advance adjusting arm (hold-down bracket) on the distributor base, and install the bolt and washer that attaches the adjusting arm to the distributor base, locating it about in the middle of the slot. Tighten it securely (the position can be changed later if necessary). You can now install and time the distributor.

Installation and Timing

NOTE: This procedure assumes that the oil pump was installed per TM 9-1840A Ordnance Maintenance – Engine, Clutch.

1. The crankshaft MUST be at top dead center, on the compression stroke for cylinder number 1.
2. Install a new cork gasket (or comparable o-ring) on the distributor and slide the distributor into the hole in the block. *NOTE: The drive tab on the end of the distributor shaft must slip into the slot in the end of the distributor drive gear. The slot and tab are slightly offset on military models, so the shaft can only be inserted in one position. The rotor should be pointing in about the seven o'clock position. If the shaft does not drop in, wiggle the rotor back and forth a bit.*
3. Install the hold-down bolt and washer through the small slot in the adjusting arm, FINGER-TIGHT ONLY.
4. Turn the distributor clockwise as far as it will go, then turn it counter-clockwise until the points are JUST ABOUT TO OPEN. A bright light will help you see it clearly. Some fine adjustment will still be necessary, but this gives you a good "starting point" for timing the ignition.

NOTE: If you can't turn the distributor far enough, you may have to loosen the bolt that mounts the adjusting arm to the distributor base and repeat this step.

5. Tighten the adjusting arm bolt, being careful not to move the distributor. If you have loosened the bolt that holds the adjusting arm to the distributor base, tighten that also.
6. Apply a film of grease to the big o-ring, and install it in the groove around the top edge of the distributor base. You can probably reuse the old o-ring if it's still soft.
7. Set the distributor cover on the distributor base, and insert the six hold-down screws and washers. Tighten them evenly in increments to make sure that the cover goes on squarely.
8. Connect the +24V power lead to the receptacle on the distributor. Screw the connector on snugly.
9. Connect the two vent lines to the distributor.
10. Connect all of the spark plug cables to the receptacles on the distributor cover in the proper order: clockwise, 1-5-3-6-2-4. Make sure that you begin with the correct receptacle on the distributor cover (you noted this earlier). The #1 cable receptacle is typically in the seven o'clock position.
11. Follow the ignition timing instructions in *TM 9-8030* to make the final adjustments.
    WARNING: *Timing the ignition involves working around high voltages and moving parts. Use common sense. Follow all manufacturers' instructions and precautions. Make sure there are no flammable or explosive materials or vapors in the area when working on ignition system components. Keep hands, clothing, test leads, etc. away from moving parts.*
    NOTE: TM 9-8030 says to set the timing between 2° BTDC and 6° ATDC, depending on altitude. However, octane rating, fuel additives, fuel volatility, carbon deposits, humidity, air-fuel ratio, and other factors make a difference. You may have to experiment a bit. In general, advance the spark as much as possible to maximize power and efficiency, but not so far that you hear any pinging (pre-ignition) when the engine is under heavy load, such as lugging it when climbing a hill. You might try advancing it a degree at a time and test driving it until you note slight pinging under heavy load conditions, then retard the timing about 2°. Later, if you hear any pinging, retard the timing a bit more.

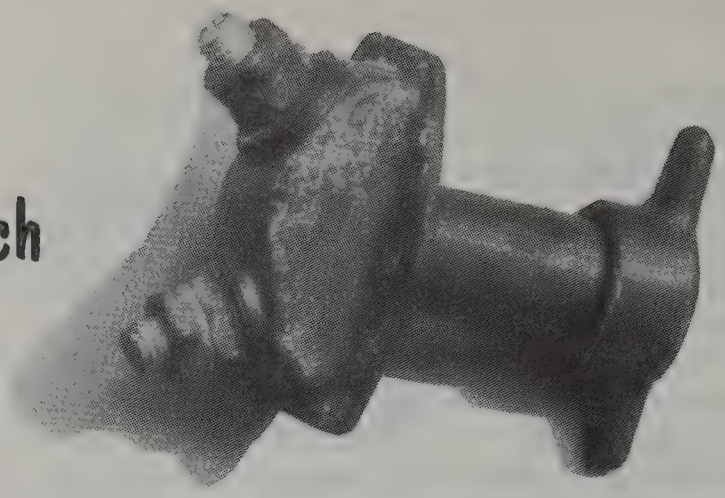
Overhaul Parts

NOS Bushing Kit – This includes two 1/2" x 5/8" x 1" sintered bronze bushings, one oil seal (if hard, use a CR-4912), two thrust washers (one large, one small), and the bushing oil wick.
NOS Breaker Plate Parts Kit – This includes two breaker plate mounting clips, one cam retainer clip, one cap-to-coil spring, and a thin metal nut for the breaker points terminal post.
Other parts: O-rings (various), cork gasket (or o-ring), breaker points (I like NAPA/Echlin CS-725A), rotor, capacitor, cap (if needed), cam assembly (if needed), shaft (if needed), fasteners and washers (as required), wires/connectors (if needed), rubber washers, 1/8-inch mild steel rod (or 1/8" x 3/4" roll pin). These (and other) suppliers carry parts...AND rebuilt distributors:

Surplus City Jeep Parts: 800-353-3772, fax 530-534-1170
Vintage Power Wagons: 515-472-4665, fax 515-472-4824
Adirondack Dodge Parts: 800-932-8020
Vermont Com'l Salvage: 802-864-4762, fax 802-863-0189
Trader John's Outpost: 847-741-3388
Antelope Valley Equipment: 800-521-8518, fax 805-942-6887
Midwest Military: 612-440-8778, fax 612-440-8776

HOW-TO...

Install a Battery Isolator Switch



by David H. Ahl

An article by Brian Asbury covered the subject of battery isolator switches quite thoroughly back in Issue #31. But now, five years later, we're going to revisit the subject, focusing especially on the military type of switch. Brian detailed the reasons for using a battery isolator switch: security (your vehicle and accessories can't be turned on by curious fingers) safety (you won't accidentally arc weld a wrench to your engine), and reliability (a slow discharge won't run down your battery).

Of course you don't have to use a switch at all; you can simply lift your hood or battery box cover, find the right wrench, detach the ground cable from your battery, close things up, and remember to reattach the cable the next time you want to start up. Actually that's just another reason to use a switch: convenience.

If you decide to purchase a battery isolator switch (you should!), there are three basic types, each of which has pros and cons:

1. Battery mount switch. This clamps directly to the negative post of your battery and is operated with a knurled knob. Pros: cheap ($10), doesn't require an extra cable, hidden access, easy installation. Con: must open hood or battery box cover to use.

2. Commercial rotary handle switch. Pros: can be mounted in convenient location, available with a key (standard $19, with key $25). Cons: installation more difficult, requires second cable.

3. Military rotary T-handle switch. Pros: looks "military," sealed contacts. Cons: same installation problems as #2, more costly ($25), potentially unreliable (read on).

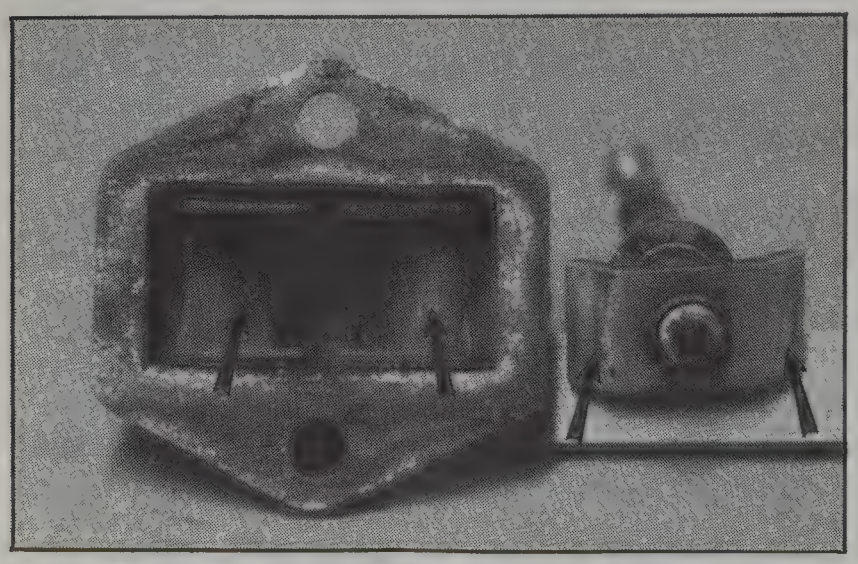
If you go with switch type #2 or #3, you'll have to purchase a second cable to go from the battery to the switch (or from the switch to ground) and use your existing cable for the other connection. You'll also need a cable lug (#2 cable, 3/8" hole) to put on the end of your existing cable that will attach to the switch.

Where should you mount your switch? Simple answer: as close to the battery as possible. For example, on an M38 or M38A1, install it on the inspection plate on the forward floor by the passenger's feet. On an M37, put in on the front seat support in the center (right by the battery cables). On an M135 or M211, put it on the removable plate on the left cowl next to the battery compartment. You can find an appropriate place in nearly any vehicle.

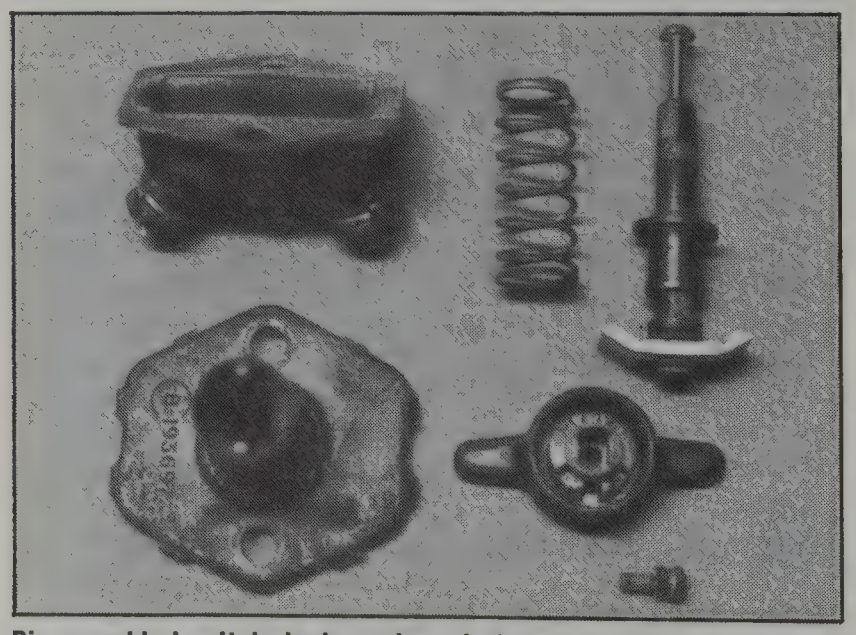
The military T-handle switch was used in Stuart and Sherman tanks. Be warned: items for/from armored vehicles are not easy to find. I looked and asked at several swap meets before I finally found a guy who had a few NOS ones available. The switch was still in the original packaging which, despite what you might think, does not totally protect against rust and corrosion for 50+ years.

If you get one of these switches, in addition to cleaning off the corrosion on the outside, use an ohmmeter to make sure that the switch is making contact. The switch is closed when the T is in line with the terminals, open when it is angled either way. If your switch, like mine, doesn't make a perfect contact (I mean *0 ohms*, after all, if this fails, your vehicle stops dead), you'll have to fix it now.

Before opening it up, try this. Undo the screw holding on the T-handle and pull the T-handle off (tap it with a hammer



Both the switch contacts on the body (right) and shaft need cleaning with a soft bristle wire brush. They should be smooth and shiny.



Disassembled switch: body, spring, shaft and contacts, top plate, T-handle, screw to hold T-handle to shaft.

if necessary). You need three hands for this next operation. Use lineman's pliers to pull up the center plunger as far as possible (you're pulling against a spring) and squirt some electrical contact cleaner down the shaft. I prefer LPS or Blue Shower, but in a pinch even WD-40 will do; *don't use* oil or any kind of lubricant.

Screw the T-handle back on and pull the handle all the way up and let it snap in. Do this about 20 times to knock the crud and corrosion off the contacts. Now, when you check it with your meter, you should have a good circuit.

If you still don't have a perfect connection, you'll have to disassemble the switch. Pry up the eight tabs (vice, screwdriver, and pliers) just enough to clear the mounting plate. Drill out the rivets using a ½" bit (just the tops). Take off the T-handle. Screw in a 10-32 screw and tap on it to separate the two parts of the switch. Catch the pieces when the two halves let go.

Clean the corrosion from the contact surfaces with a soft bristle wire brush. Use a stiff wire brush on the shaft, spring, and anything else that needs cleaning.

Reassemble the switch. My switch is no longer sealed at the shaft and I don't plan to use it under water, but for the heck of it I smeared some Permatex on the mating surfaces; use your own judgement. Important: the large end of the spring goes into the shaft first; the small end goes at the bottom (near the contacts). Assemble it the other way around and the switch won't work. Use a hammer and pliers to tap and squeeze the tabs back into place. Reattach the T-handle. Test it. If it doesn't work, change your hobby to butterfly collecting.

Oh, yes, the rivets. Forget 'em (golly, am I admitting that I'm not a purist?). Use ¼" bolts instead of #10's to mount your switch (see below) with an extra nut to hold the two switch halves together, and you'll be fine.

You can mount this switch in one of two ways: surface mount or recessed. A surface mount requires that you cut a 2¼" x 1⅛" hole and drill two #10 screw holes. Fasten the switch to the mounting surface with two ½" #10 machine screws. The T-handle and shaft will then protrude 2¼" from the surface on which the switch is mounted.

If you want less protrusion, go with a recessed mount. For a spacer, cut a 1" long piece of cast iron pipe with 1" inner dia. (or use a nipple). With a hole saw or reamer, make a ⅞" hole where you want the switch and drill two #10 screw holes. Take the T-handle off the switch, slip the pipe on the bottom of the switch shaft, and pass the top of the shaft through your ⅞" hole. Use two 1½" #10 machine screws to fasten the switch and pipe assembly to the mounting surface. Then screw the T-handle back on.

I don't know why the Army didn't put battery isolation switches on all military vehicles. Don't you make the same mistake.

Sources:

- Battery mount switch: Fred Jones, 336 Prospect St., Elyria, OH 44035, 216-322-3158.
- Rotary switch: Bathurst, Inc., Box 27, Tyrone, PA 16686, 814-684-2603 or J.C. Whitney, Box 8410, Chicago, IL 60680, 312-431-6102.
- Military switch: David Yamulla, 980 N. Laurel St., Hazelton, PA 18201.

M37 dash controls for a vehicle equipped with a fording kit.

Installing Free-Wheeling Hubs

by David H. Ahl

Want to reduce wear on your drivetrain, cut down noise, make steering easier, and increase gas mileage? Of course you do, and one of the easiest ways to do so is to replace your existing hubs with locking (or free-wheeling) hubs.

Hubs and How They Work

The hubs are the devices at the end of your axles that hold your wheels onto the vehicle. The outer part of the hub is the drive flange; it bolts onto the wheel and brake drum and has in its center a female spline that fits over the male spline of the axle. It is always engaged.

When you shift into four-wheel drive, the transfer case engages the front driveshaft which turns the front differential, front axles, and, through the hubs, the front wheels. When you shift into two-wheel drive, the front driveshaft, differential, and axles are not driven from the transfer case but, in fact, they still continue to turn because the front wheels (which turn when you are moving, of course) are still coupled to the axles by the hubs.

Locking hubs can be manually locked to or unlocked from the axle. When they are locked, they function exactly like your original hubs. But when they are unlocked, they allow the wheel to turn freely on the axle. The front axles, gears in the front differential, and front driveshaft just sit quietly, putting no extra drag on the front wheels.

All of your driving on dry pavement should be in 2WD with the front hubs unlocked. When you need 4WD for off-road use or slippery surfaces, you'll have to stop, get out of the vehicle, and turn each front hub 1/4 turn to lock them onto the axles. Then when you shift the transfer case into 4WD, all four wheels will be engaged.

After installing locking hubs, every month or so you should shift into 4WD for about a mile so the lubricant on the front drive chain doesn't harden up. When you do this, it doesn't matter whether the hubs are locked or not.

Installing Locking Hubs

For our M37, we got a set of Superwinch locking hubs (#400508, the same hub as used on the civilian Dodge W300M Power Wagon). It took about 40 minutes to install both hubs. Here's how to do it.

Remove the existing drive flange by removing the six 9/16" nuts and lockwashers from the flange studs (see paragraph 205c in TM-9-8030). If a stud comes out, as four of ours did, slather on some Liquid Wrench and let it sit for a while. Then put the stud in a vise and remove the nut. Reinstall the stud by putting two nuts on it, jamming them together (outer wrench clockwise, inner wrench counterclockwise), and screw it back in by turning both wrenches together.

Remove the two 7/16" square puller screws; you may need a 5/8" deep socket to start the puller screw locknut. Remove the nuts from the puller screws, put the screws back in their holes, and tighten them evenly (alternate turning each one 1/2 turn) to force the flange off the hub. Remove the flange and flange gasket. Clean off the gasket surface.

Take each new locking hub, set the control dial to the 4x2 (unlocked) position, loosen the screws using a 1/8" allen wrench, and separate the two sub-assemblies.

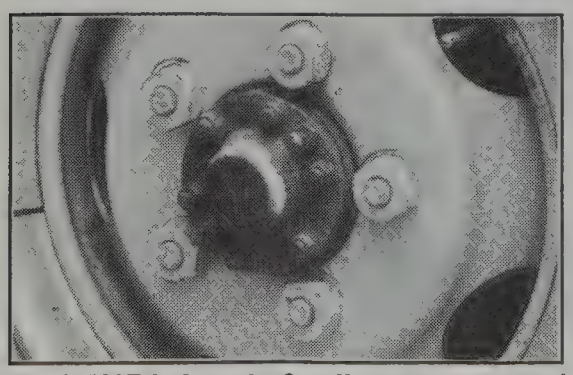
Install the hub body with a new gasket (comes in the hub kit) using the original 3/8-24NF nuts and new 3/8" lockwashers. Tighten to 30-35 pound-feet torque. Then attach the hub cover assembly with the six furnished screws using a 1/8" allen wrench. Voila, you're done.

No maintenance is required; the Superwinch hubs are permanently lubricated. To use, you simply turn the dial 1/4 turn clockwise to the locked 4x4 position or 1/4 turn counterclockwise to the unlocked (disengaged) 4x2 position.

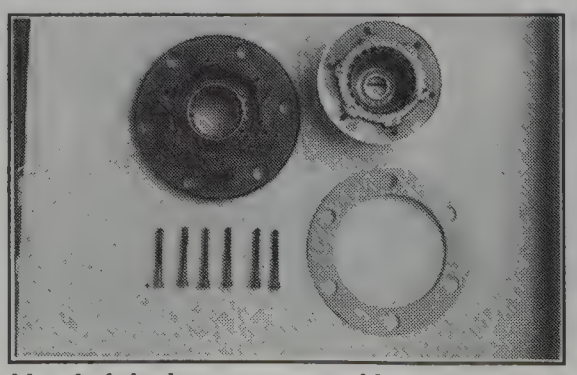
Locking hubs are available for most popular military vehicles (MB/GPW, M38, Dodge WC series, M715, most deuce-and-a-halfs, and M-series 5-ton trucks). Hubs are made by Superwinch and five or six other manufacturers. Check with your favorite vendor for availability.

What You Need for an M37

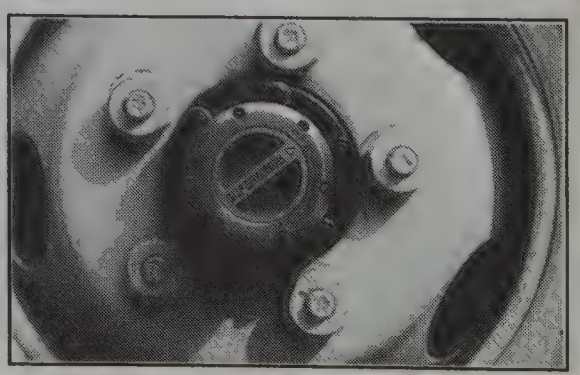
Superwinch Locking Hubs (#400508 for M37)	Torque Wrench
12 3/8" split lockwashers	9/16" open end wrench
7/16", 9/16", 5/8" sockets	1/8" allen (hex) wrench
	Liquid Wrench



Stock M37 hub; note 2 puller screws.



Locking hub body, cover assembly, screws, gasket.



1/4 turn of dial engages locking hub.

Replacing M37 Rear Seals

by Phil Kern

For some reason, many less-experienced military vehicle owners are reluctant to dig too deeply into the mechanical innards of their pride and joy. Perhaps they feel it is too complicated or requires special tools or they worry that their vehicle will be out of commission for months. Or perhaps it is a combination of these concerns. The fact is that most MVs are fairly simple and were designed to be maintained by a kid fresh out of high school with no particular mechanical knowledge.

In the case of the M37 rear axle assembly, no special knowledge is required. Only one special tool is necessary to work on the outboard parts, and you don't have to disassemble the whole axle. The seals on each side can be replaced in an hour or less once you get the hang of it.

What's the big deal about seals on an M37? To begin with, leaky rear seals are a common problem on these trucks. I have owned four M37s, and they all needed seals to some extent, although some were much worse than others. You know your M37 needs help when, after topping off your four (count 'em, four) gear cases with gear oil, you start finding that your truck has marked its territory all over your driveway or garage floor.

If you are not checking your cases regularly, you'd better get in the habit or you may find yourself looking for somebody with a spare transfer case. The transfer is the most likely to have a serious leak because of the number of shafts, and it is the first to blow due to lack of gear oil—but that's another story. Don't be concerned about minor drips from your truck. Remember, if it doesn't leak, it's not military.

The other concern is that when the seals give up the ghost, gear oil soaks your brake shoes, and the last thing an M37 needs is reduced braking capacity. This also applies to the ¾-ton Dodges of WW II and the civilian Power Wagons, all of which use the same type of axle—some are wider, some narrower—but the seals, bearings, and other repair parts are basically identical.

How to tell when you need seals? If there is *any* gear oil on the outside of the wheel, you have already waited too long. Keep an eye on the inside of the wheel, which is where leaks appear first, and plan a "Save the Seals" weekend when it becomes apparent that the leak is chronic or you notice a loss of braking capacity.

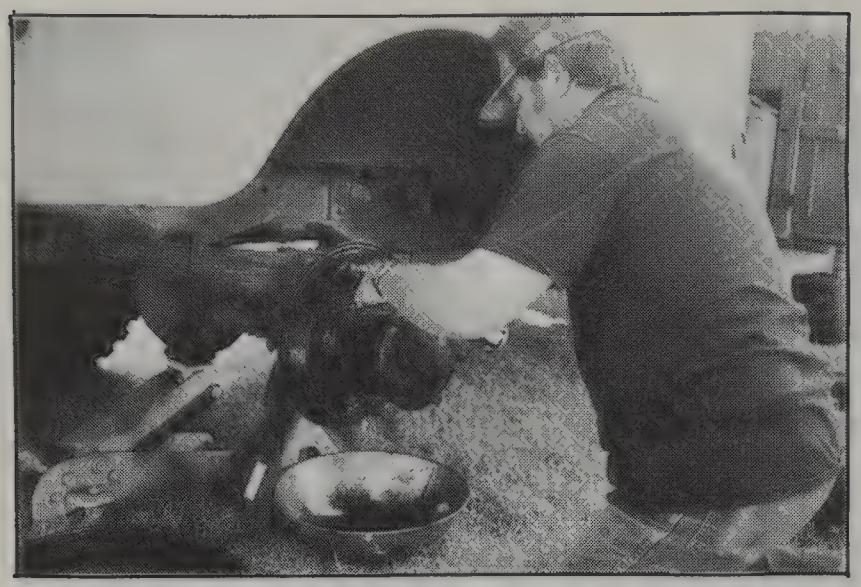
Well, let's go ahead and dive into it. Our victim this time will be Mike Coen of San Diego and his '65 M43B1 ambulance. Mike has been complaining about his meat wagon relieving itself in his driveway and an accompanying decrease in braking power. Actually, having driven his 383 V-8 powered ambulance in the past, I don't think it had much in the way of brakes to begin with. Nevertheless, I was able to convince him that an improvement could be expected in this area when the rear brake shoes were not saturated with gear oil.

I do not intend to rehash the procedure in TM 9-8030, because it makes the job seem more complicated than it really is. The overall procedure is covered in several sections in the TM with paragraph 228 providing the best instructions and a nice graphic of the front axle, but you will end up flipping a lot of pages for the whole story. You won't have to crawl under the truck, but this is a messy job, so leave your dress uniform in the closet. You will need the following parts to do the rear axle only:

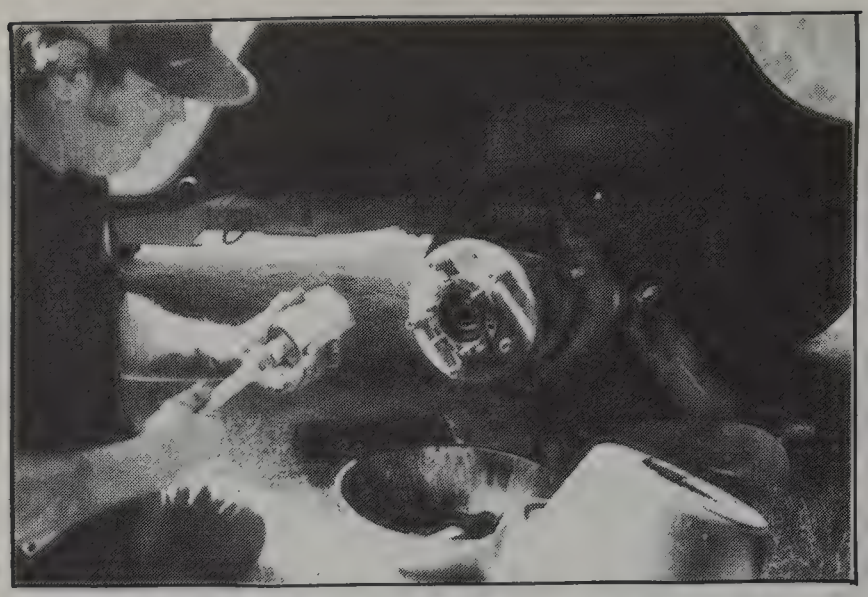
Part Name	*Ordnance Part No.*	*Chrysler Part No.*	*Civilian Part No.*	*No. Req'd*
Inner Seal	500174	CC-915499	CR 28116	2
Outer Seal	500125	CC-915496	CR 20766	2
Gasket	7351041	CC-915565	NAPA J26288	4

After the truck is jacked up and the wheel removed, use your handy impact driver to see if you can loosen the brake drum screws. The splatter on the quarter panel of the ambulance is gear oil thrown off the rear wheel.

The brake drum can be removed after the screws are drilled out. Assistance is provided by the puller screws, one of which can be seen sticking out of the face of the drum.



Hopefully, your truck isn't this bad—everything behind the drum coated with gear oil. It took several cans of brake cleaner and a stiff brush to reveal red paint underneath this mess.



Only one special tool is required for this job—a large oddball socket for removing and tightening the two bearing nuts. If you have an old Dodge there should be one in your tool box.

Total cost for the parts should be in the $50 to $80 range, as the seals seem to run $10 to $15 each. The front axle is similar, but there are no outer seals to worry about. This is also a good time to do brakes and bearings if you want to, but you won't know what parts are needed until you complete your initial inspection, and that work is beyond the scope of this article.

First, jack up the truck and place a jack stand under the axle. Remove the wheel and center punch the axle flange and hub directly across from each other. The splines on the axle and differential get to know each other, and the studs also like it when you reassemble the axle in the same position. Remove the six nuts and lock washers from the studs holding the axle flange, and remove the axle using the two puller screws that should be attached to the axle flange.

Each hub should have two 3/8-16 square head puller screws sticking out of the axle flange, with a 5/8" nut holding them in place. If these are missing, now is the time to replace them. If your original 3/8-24x7/16-14 studs and nuts have been replaced with bolts by some amateur, the same goes for them. The axle should slide out easily as you alternately tighten the puller screws in the two holes in the flange. Have a pan under the hub to catch the gear oil as the axle is removed, and you should be able to pull the outside seal with its paper gaskets off the hub and studs with your fingers. If you find, as Mike did, that there is no outer seal or paper gaskets at all, you begin to grasp the problem.

Among the truly wonderful design features of the early ¾- and 1-ton 4x4 Dodges are the three pesky little screws that hold the brake drum to the hub. These are exposed on both sides to the elements and located down low on the truck where they collect dirt and water, so you will be faced with two choices at this point: either the screws will come right off with the impact driver, which usually means somebody has messed with the truck since 1960, or they won't come out at all, which means your truck is unmolested but you will have to drill out the screws. I prefer the latter, using an undersized drill and the same two puller screws on the brake drum to apply stress to these 3/8-16 flat head machine screws until they snap off. The rest of the screw is easily removed from the back of the hub, but machine screws this large are not easy to replace. When you find them, even if they are Phillips or Allen head unlike the originals, pick up a bunch of them for spares.

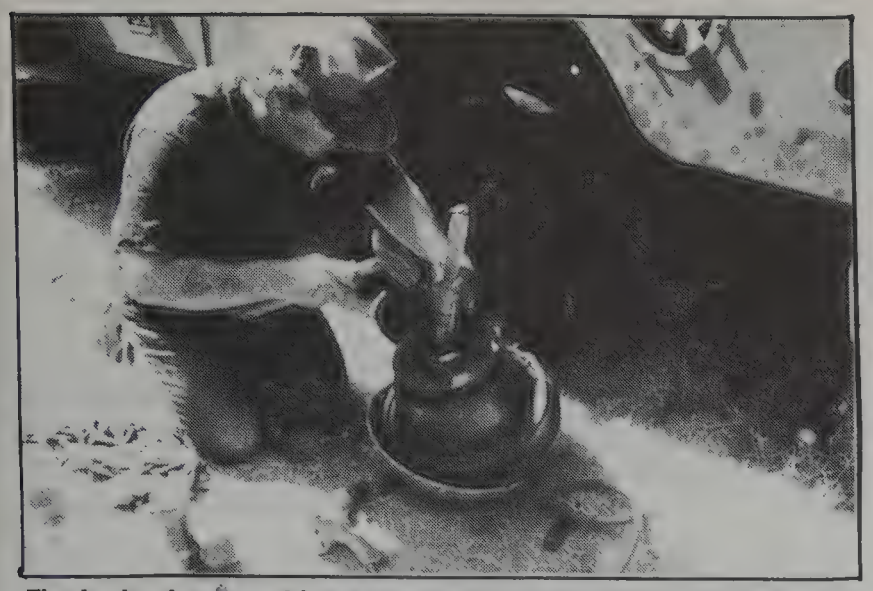
When the drum has been eased off the hub and brake shoes, it is time for the grim reality of inspection. In Mike's case there was so much congealed gear oil on the drum, shoes, hub, and backing plate that I don't think there were any brakes at all left on the rear axle. It was time to go to work with a stiff brush and a couple cans of brake cleaner. Mike brought two and ended up going back for a six pack (of brake cleaner, that is).

Remove the return spring from the top of the brake shoes to drop them down while carefully clamping each end of the wheel cylinder to keep the pistons and boots in place. Clean the shoes completely along with the backing plate behind them. The heat of driving can liquefy any excess gear oil left behind and allow it to drip on to the shoes later on. Get the hub and drum as clean as you can too, with your drip pan still in place to catch the solvent.

This next part will require the special Dodge wheel bearing nut tool, a ¾" drive 2-9/16" *octagonal* socket wrench. You can get one from any of a number of specialty tool and surplus dealers for about $20. Mine is a BWP part number M-1905. If you don't have one for your Dodge, you should go ahead and make the investment, at least so you can adjust wheel bearings.

Using this wrench, remove the outer wheel bearing nut, pick out the perforated lock ring with a couple of small screwdrivers or needlenose pliers and remove the inner wheel bearing nut with the wrench. Don't be surprised to find nicks and gouges in the large nuts; many shade tree mechanics, lacking the proper tool, use a cold chisel to loosen the nuts. If this is the case smooth out any projecting pieces of metal with a file and remove any shavings before reinstalling the nuts.

With the nuts off, the entire hub assembly can be carefully removed. The outer bearing will have a tendency to fall right in your lap or in the dirt depending on your position relative to the truck. You can check your bearing cones and cups for excessive wear, but rarely have I found these to be bad, because they seem to be well lubricated by gear oil from the



The brake drum provides a good base for the hub as you gently tap the inner bearing and seal out of the hub with a hammer and dowel. Don't forget to remove the retainer ring first.

axle housing.

Next, remove the retainer ring from the inside of the hub, place the neck of the hub through the brake drum, and set both on a solid surface. You can now remove the inner seal by tapping lightly around in a circle on the bearing with a hammer and wooden dowel. During the disassembly, I like to arrange the parts in the order in which they are supposed to be reinstalled, but Fig. 11-1 of ORD 9 SNL G-741 or Fig. 190 of TM 9-8030 are excellent references and will keep you from having to take the darn thing back apart if you forget something.

Replacement seals come in two types. Older ones have a leather seal lip; newer ones are made of neoprene. Some people seem to think the leather ones are a little more pliable and seal better on older, worn parts but either type is acceptable unless the lip is dried and cracked. The leather type must be soaked overnight in Neatsfoot or similar light oil and rolled with a steel bar to make them more pliable, as shown in the TM.

Assuming your bearings are OK, grease and reinstall the inner bearing and drive the seal in, after conditioning, with the lip towards the bearing. A very large socket or dowel usually works best for this and doesn't distort the metal parts of the seal. Don't drive the seal in any further than absolutely necessary, and reinstall the retainer ring. The hub assembly can now be replaced on the axle housing and the outer bearing slid over the axle housing and into the hub.

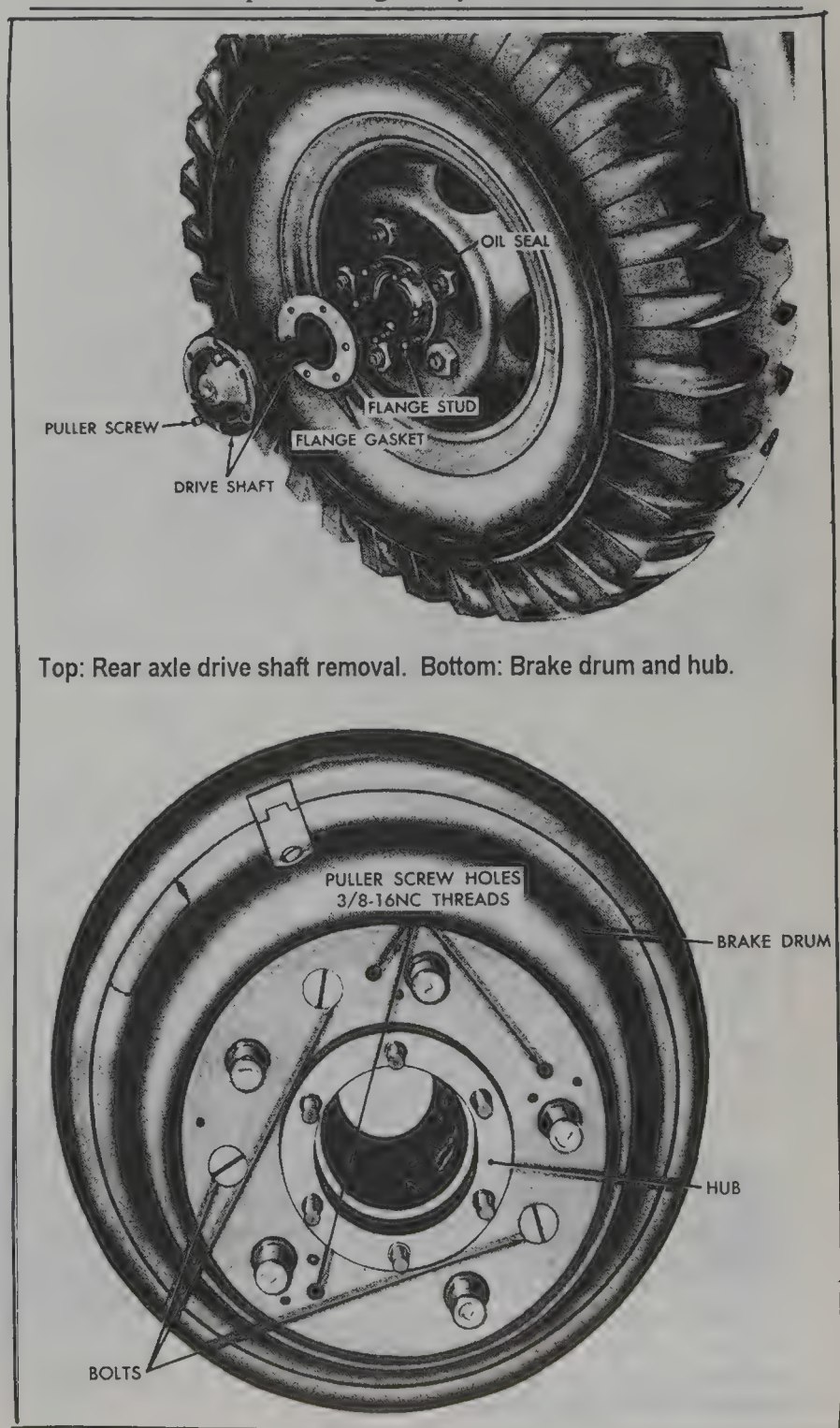
If you have a broken or stripped wheel stud, now is the time to replace that too, remembering the proper threads for the side of the vehicle you are working on. (I have seen left and right hand studs mixed on the same wheel by some knucklehead.)

The inner wheel bearing nut can now be replaced with the small raised nub on the outside. Using your new tool, tighten the inner nut down snug, then back it off 1/6 turn or the equivalent of one stud on the hub. Slide the lock plate over the axle housing with the tab in the slot, making sure the nub fits into one of the holes. If it doesn't, reverse the adjusting nut lock or turn the inner nut slightly. If the wheel spins smoothly without looseness, the outer nut can now be installed and torqued down with the special wrench.

You can now pull the brake shoes back up and replace the return spring, brake drum, and its three screws with Never-Seize compound. Place an axle flange gasket, an outer seal with the raised part towards the inside, and another gasket over the flange studs in that order. You can now replace the axle, aligning the two punch marks made earlier. Align the marks first, rotate the wheel to align the studs, and push in and slightly up to engage the splines on the axle. Replace the nuts and lock washers on the studs, and replace the wheel and lug nuts.

That's it; you are done—with one corner anyway. One thing to watch for on the front is that some aftermarket locking hubs are significantly larger in diameter than the opening in the brake drum or even the wheel. This should be obvious upon disassembly. Just plan to replace the front hub last, after everything else is in place.

When all four corners are done, your wheel bearings should be properly adjusted and lubed, your brakes should be clean and functional, and your old Dodge truck should not be befouling your driveway anymore. Now, if we can only get the transfer case to quit leaking—maybe in a future issue.



Top: Rear axle drive shaft removal. Bottom: Brake drum and hub.

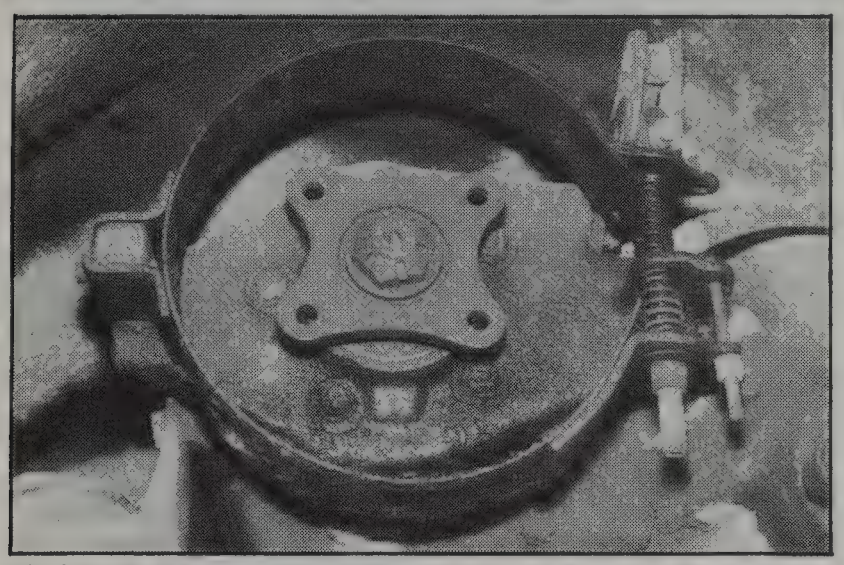
HOW TO...

Handbrake Replacement on M37

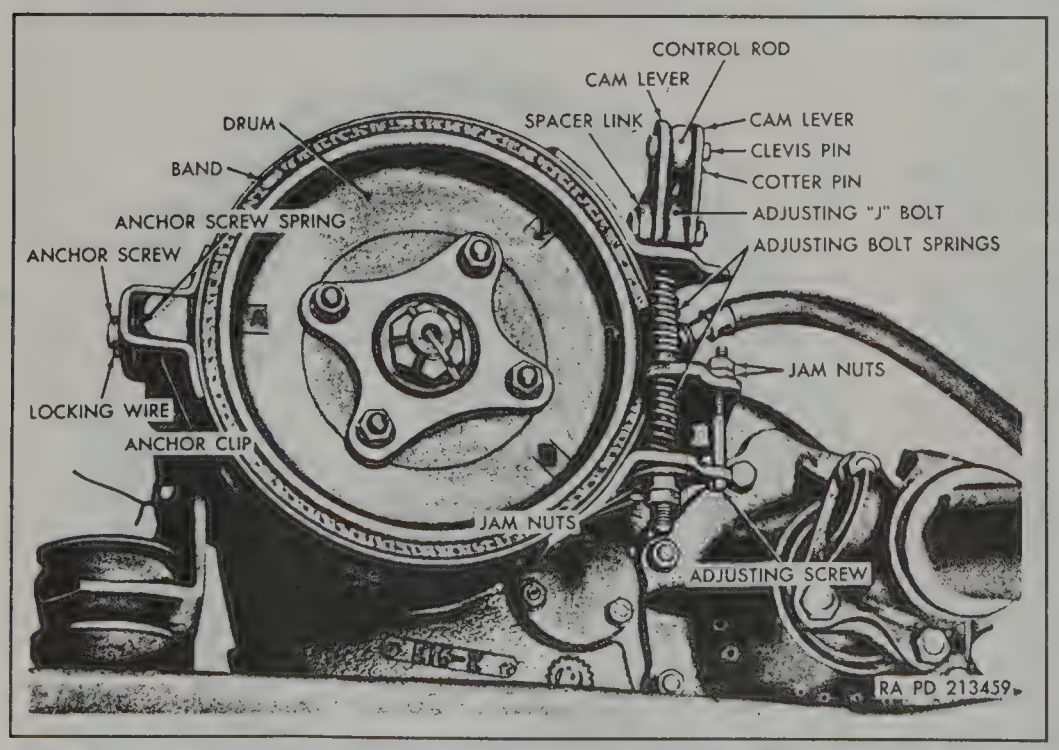
by David H. Ahl

You'll recall in our last Project Vehicle installment (Issue #62) that I noted that the emergency (hand) brake drum and lining, which is actually on the rear of the transfer case of the M37, was missing. So I bought an NOS drum and lining to make the repair. Actually, after I bought the lining and considered drilling and countersinking 18 holes and attaching it to the band with 18 3/16" brass recessed rivets, I decided I'd be better off getting a band with the lining already riveted on. So I bought one and resold my new lining to a guy at Aberdeen—anyone want to buy a band sans lining?

Okay, so it's get out TM 9-8030 and TM 9-8031-2 and follow the instructions to remove the handbrake band and drum. First step: make enlarged copies of the drawings so I can see what I'm doing while lying under the vehicle.



Old handbrake assembly on the vehicle: no drum, no brake lining, and adjustment screw is upside down.



Handbrake assembly as it appears in the manual. Note the difference between this drawing and the photo above.

The band came off with no real problems except for the fact that the band-adjusting screw was installed upside down, making it next to impossible to keep it from turning with a slotted screwdriver held from above. Vise Grips around the shaft did the trick and allowed me to remove the jam nuts.

But then I came to the 7/8" nut securing the flange to which the drum is normally attached. When I tried turning it, all the drive shafts turned, the engine crankshaft turned, and the M37 actually moved forward a few inches. Not good. So I took the largest pipe wrench I had (4" jaw), clamped it around the rear U-joint (apologies to Steve Turchet) on the main drive shaft, put a long-handled 3/4" socket wrench on the nut, and pushed on that puppy—hard. The pipe wrench locked against the frame and slowly, slowly, the nut came loose.

Once I had everything apart, I cleaned all the parts thoroughly including running appropriate size dies (as in tap and die) on the various adjusting screws to clean out the threads. For accurate jam nut adjustments, you need good, clean threads. The anchor screw spring was missing, so I went to my collection of springs and found one that seemed about right. This is an important item because without it the center of the lining will always be in contact with the drum.

I attached the new brake drum to the flange with 3/8"-16 NC hex bolts, nuts, and lock washers (yes, I know they should have been 24-thread bolts, but it was late Saturday and that's all I had at home). The rule here is "plan ahead, or the small stuff will get you every time."

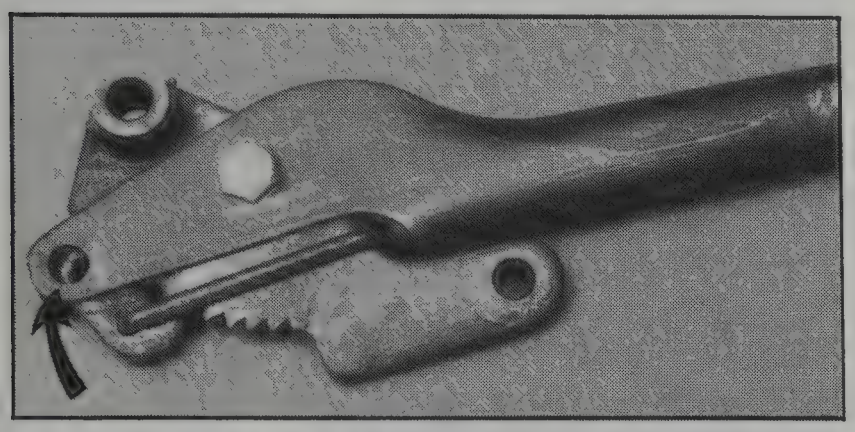
With clean parts, the reassembly was fairly easy except when I inadvertently skipped part of one of the steps in the manual. Adjustment was not so easy. The manual calls for inserting a 0.015-inch thickness gauge between the brake lining and drum in three places around the periphery. A typical flat metal thickness gauge ½" wide and 0.015" thick will not easily conform to the curvature of the drum. On the other hand, a wire gauge is not wide enough to give an accurate measurement against the irregular surface of the brake lining. As an electronics nut, I had a bunch of 0.015" speaker shims about 1/8" wide that worked fine. Alternatively, you could probably use some strips cut from a heavy manila file folder—they're almost exactly 0.015" thick.

A few hours later everything was back together. I got in the cab, pulled on the handbrake handle, and...nothing. I considered screaming. I considered taking up origami. Instead I popped a cold one, slid back underneath, and examined

the whole system. The only explanation I could think of was the rachet, but the teeth and mechanism both *seemed* fine.

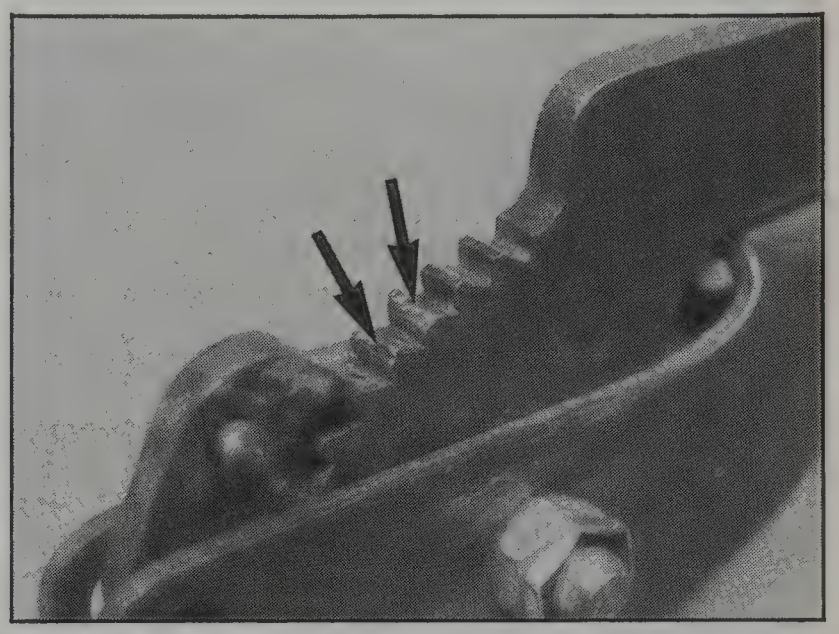
A few days later I talked to George Mainieri at Vermont Commercial Salvage. He was convinced that the rachet teeth were bad, so I ordered an entire new handbrake lever, rod, and pawl assembly, which arrived a few days later.

I looked at the removal and installation instructions in my manual. Only four steps, a piece of cake, I thought...until I saw that Step 1 refered me 30 pages away to paragraph 121g that had three more steps, one of which was to remove 18 stuck and corroded lock washer screws in the cab, all of which had their heads worn off, which will then allow the transmission access and cut-out covers to be removed. And this was only Step 1.



When installing a handbrake assembly (this is the old one), it takes two to tango—or to align the lever and sector holes with the bolt.

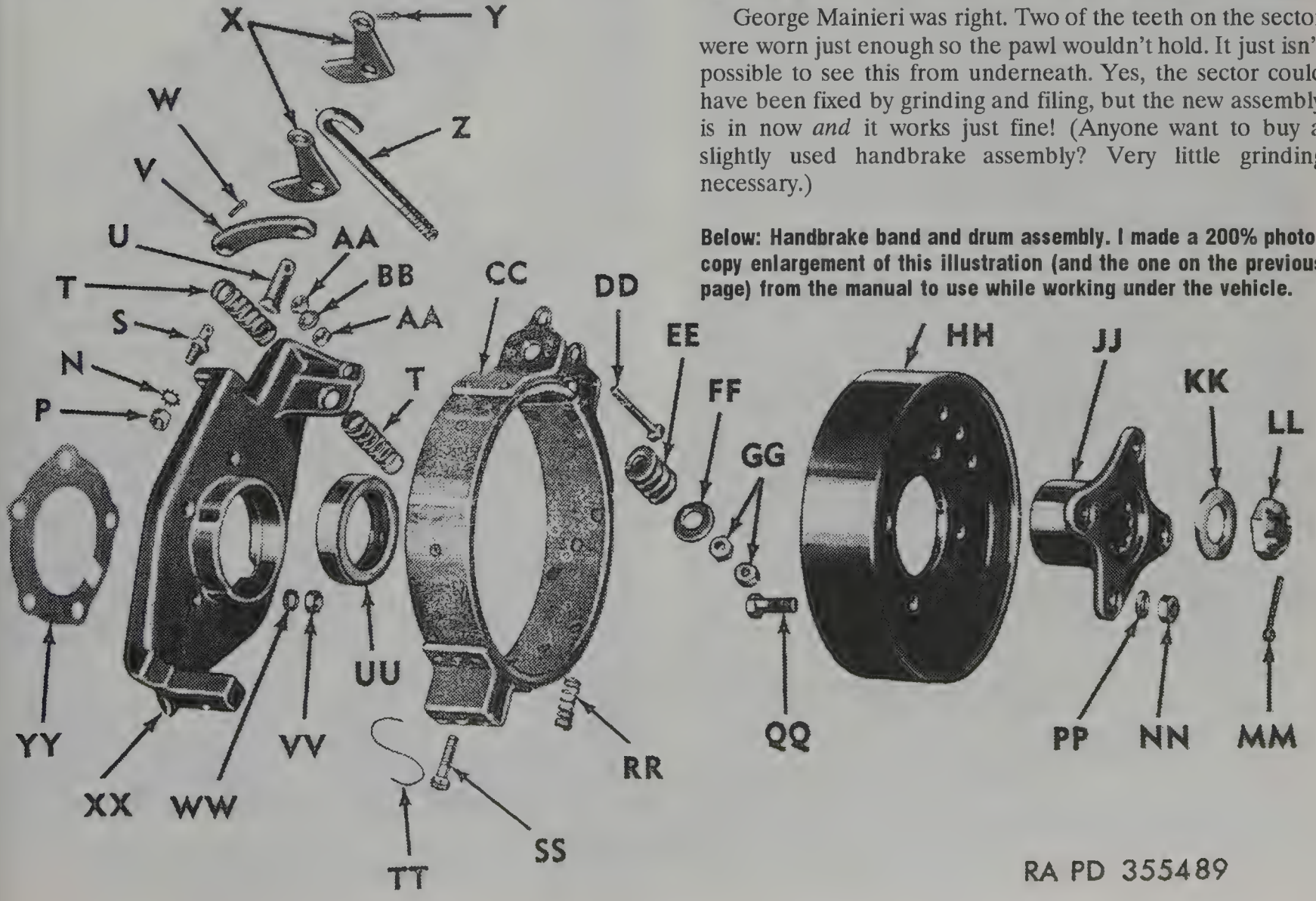
Rick Frei, a local MV club member, came to my rescue and told me that if two people work together—one under and one in the cab—you can replace the handbrake by taking off only the cut-out cover. He's right, but I'll tell you that it's no picnic trying to align the holes in the handbrake lever and "sector" (the part of the assembly with the rachet teeth) with the corresponding bolt. "You got a big hammer?" says Rick from under the M37, "maybe it'll help." Finally, by my jiggling the handle and button from above and Rick tapping (with a small hammer) underneath, it all went back together.



Two critical teeth on the sector are too worn to engage the pawl.

George Mainieri was right. Two of the teeth on the sector were worn just enough so the pawl wouldn't hold. It just isn't possible to see this from underneath. Yes, the sector could have been fixed by grinding and filing, but the new assembly is in now *and* it works just fine! (Anyone want to buy a slightly used handbrake assembly? Very little grinding necessary.)

Below: Handbrake band and drum assembly. I made a 200% photocopy enlargement of this illustration (and the one on the previous page) from the manual to use while working under the vehicle.



A Rifle Mount for Your Vehicle

by David H. Ahl

If you are restoring a military vehicle to the way it might have been in combat, one of the first things you will want to add are weapons. But you can't just toss a couple of rifles in the back—well I guess you can—but if you want to do it right, you'll want to add the correct rifle mount for your particular vehicle.

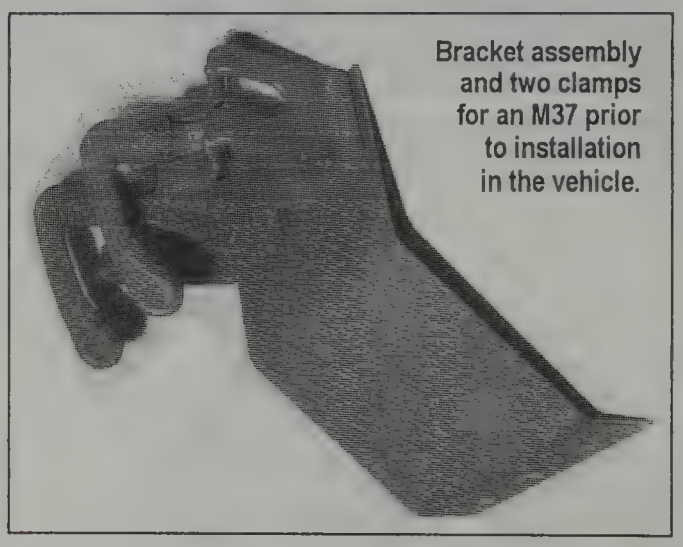
For M-series vehicles from the 1950's through the 1980's, Technical Bulletin 9-2300-209-20 defines the stowage locations and provides plans for the bracket assemblies. Look over the TB and then buy yourself a single or double M14/M16 rifle mounting kit; cost is about $12 for a single and $18 for a double kit from many of our advertisers. Personally, I'd get a double kit.

Most of the kits currently on the market are for the M151 or M35 deuce-and-a-half. Each single kit comes with a bracket assembly, floor plate, clamp assembly, four bolts, and four self-locking nuts. A double kit comes with two of everything except the bracket assembly. If you manage to find a kit for your specific vehicle, installation is a breeze. But, if you have an M37, for example, you'll have to make the bracket assembly using the plans in the TB.

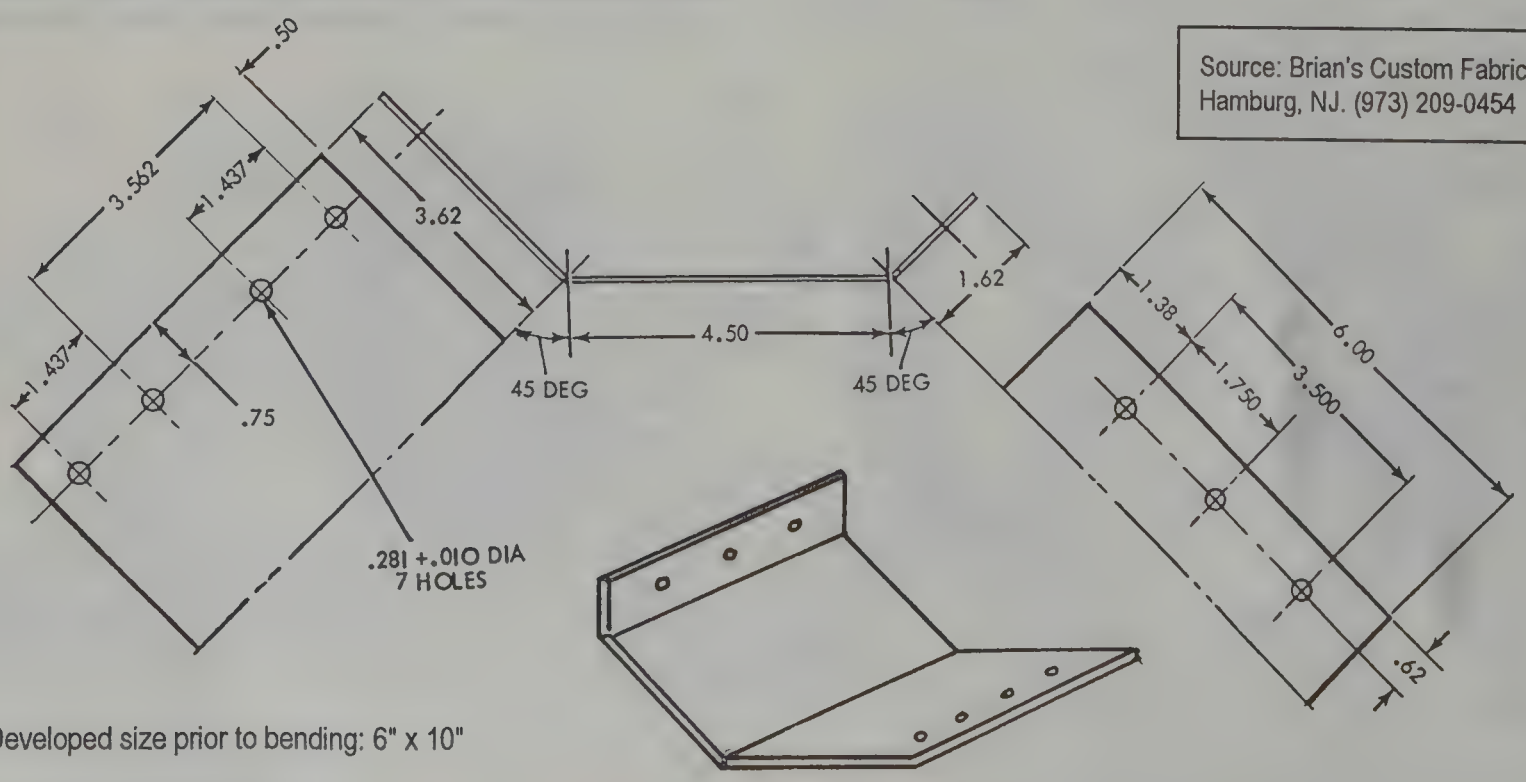
For an M37, you need a 6" x 10" piece of 1/8" steel. Think this is easy to find? Think again. I tried sheet metal shops, an electrical box fabricator, and a truck body shop and could only come up with a hunk of diamond plate. Finally, I found a piece at a custom metal fabricating shop. Two 45° bends are required—relatively easy to do with a heavy metal brake—next to impossible to do neatly with a vise and hammer. You must then drill seven slightly larger than ¼" holes (start with a small drill and work your way up). Measure and drill precisely or the clamps won't fit.

Once your bracket is bent and drilled, hit it with metal prep, a couple of coats of primer, and a couple of color coats. The parts of the kits are all flat forest green (34079) to match camo paint era interiors. Depending upon your vehicle, you'll have to drill three or four holes in or under the dash to the right of the instrument panel and four holes in the floorboard. Bolt the clamp handles to the bracket and the bracket to the dash, and bolt the floor plates to the cab floor and you're ready to go. I might mention that the floor plates pictured in the TB are oval whereas the ones in most of the kits that I've seen are rectangular; it doesn't matter as they both work fine.

One last recommendation: even though I have dummy rifles in my cab, I put a bicycle cable lock thought the trigger guards and the floor plates so that some kid doesn't "borrow" one of the rifles to menace the local populace.

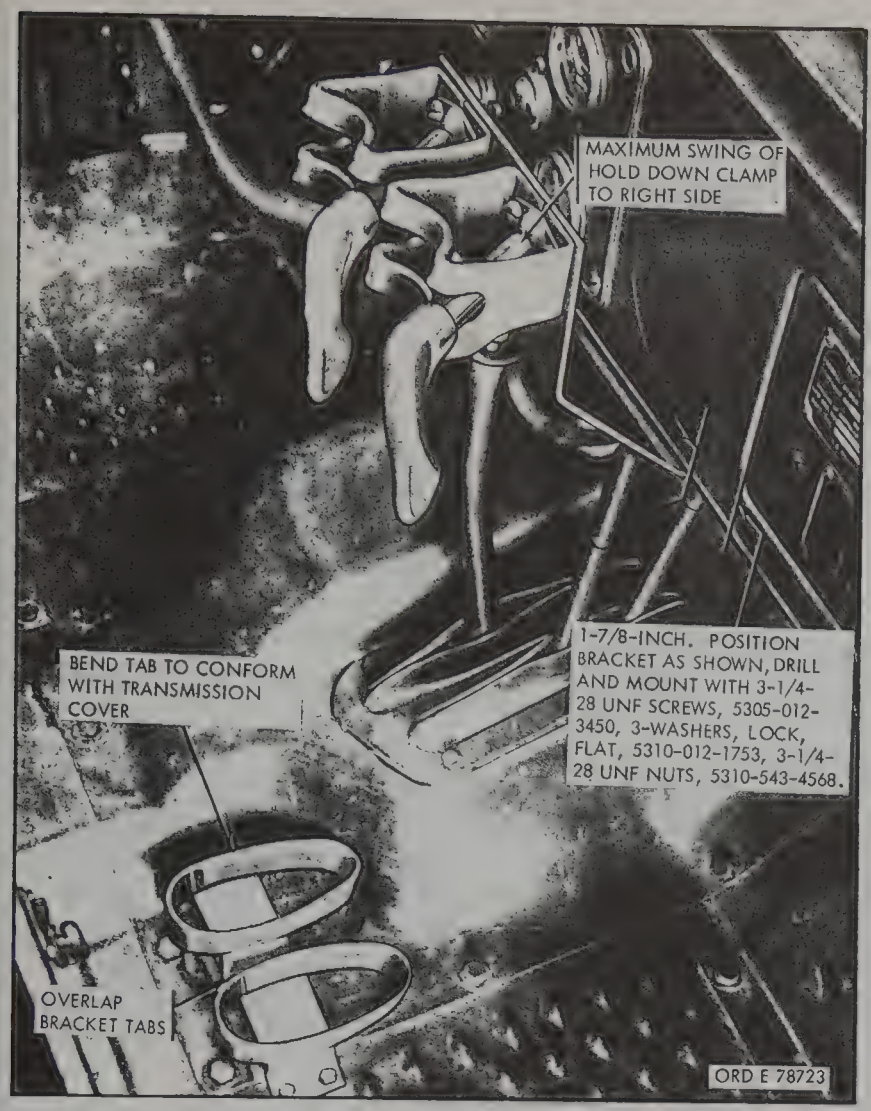


Bracket assembly and two clamps for an M37 prior to installation in the vehicle.



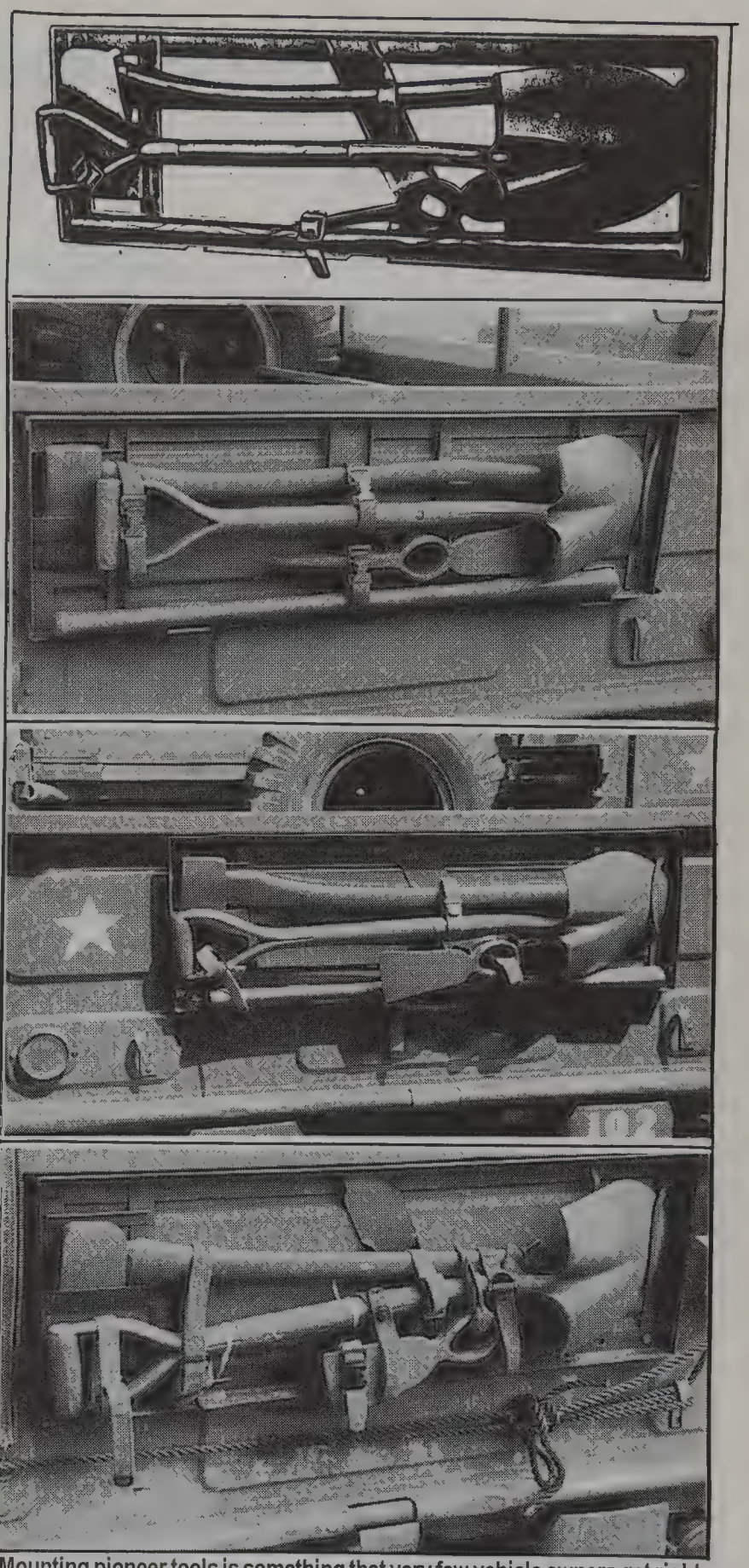
Source: Brian's Custom Fabricating
Hamburg, NJ. (973) 209-0454

Developed size prior to bending: 6" x 10"


MAXIMUM SWING OF HOLD DOWN CLAMP TO RIGHT SIDE
1-7/8-INCH. POSITION BRACKET AS SHOWN, DRILL AND MOUNT WITH 3-1/4-28 UNF SCREWS, 5305-012-3450, 3-WASHERS, LOCK, FLAT, 5310-012-1753, 3-1/4-28 UNF NUTS, 5310-543-4568.
BEND TAB TO CONFORM WITH TRANSMISSION COVER
OVERLAP BRACKET TABS
ORD E 78723

Top: M37 dash mount with double brackets and double floor plates. Bottom: M14 and M16 rifles secured in brackets.

Mounting Pioneer Tools



Mounting pioneer tools is something that very few vehicle owners get right. The theory is to mount each tool using just *one web strap* so each tool can be removed individually by removing only one strap. As the illustration shows: axe handle: one strap, shovel handle: one strap, mattock head and handle: one strap. The top photo looks tidy, but it is just plain wrong with two straps around two tools. In the middle photo, the mattock head points the wrong way and one strap is around two tools. In the bottom photo, the mattock handle is missing, the tools are positioned incorrectly, and there are four extra straps! For the mattock head to fit snugly, you may have to bend the tabs that hold it into place.

Beefing Up Your Springs

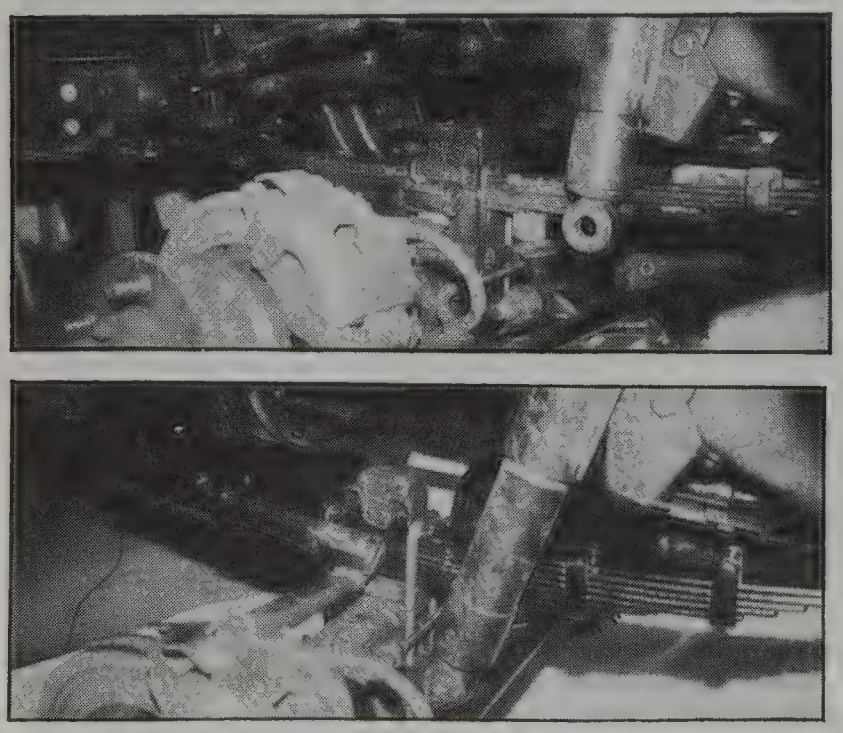
by Daniel Pinkham

While Dan beefed up the springs on an M37, his approach is applicable to any vehicle with sagging springs, especially if the sag is due to heavier-than-normal loads or increased vehicle weight. —*DHA*

In looking over the data on an M37 with and without a winch and on an M43 ambulance, I noticed that the vehicle weights and axle weights vary considerably as a result of the weight of the winch or ambulance body. Were heavier springs used on the front axles of winch-equipped vehicles and on the rear axles of ambulance-bodied vehicles? It seems that they must have been.

When delivered in August of 1982, my own non-winch M37B1 had a front-axle weight of 2981 lbs. empty and a rear-axle weight of 2706 lbs. Today, as a result of a Hercules diesel engine conversion plus an after-market winch, the front end weighs in at 3900 lbs., more than 900 lbs. over the original weight. The rear-axle weight is about the same. After three years, this additional weight coupled with normal deterioration caused a noticeable sag in the front end of my truck. So I decided to do something about it.

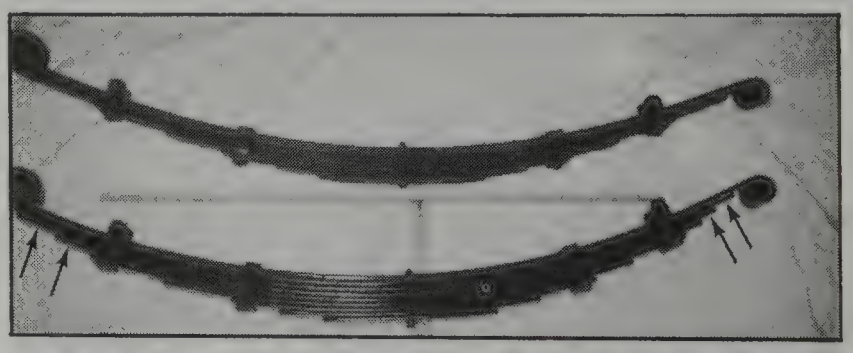
Following the directions in TM 9-8030, I removed the front springs and took them to a suspension shop that routinely rebuilds heavy truck springs. Based on the increased weight, they recommended adding two extra leaves (nine total) and bending them back to the original arc of 5.25". Since I had several old springs on my parts trucks, I saved some money by scrounging the extra leaves from them, which the shop then modified and installed.



Top: Old 7-leaf front springs have too little arc due to heavy diesel engine plus normal deterioation. Bottom: Springs have been bent back to original 5.25" of arc and two extra leaves added.

Re-installation was straight out of the manual. Fortunately, the original U-bolts were long enough to reuse on the thicker springs. I find that my truck rides a little stiffer now, but it still rides smoother than ny 1954 M38A1 Jeep. I do not believe that these springs will sag, but only time will tell.

I solved one other minor problem while the front springs were off. My M37 was always a bit crooked, with the driver's side high. After cleaning off the grease, oil, and layers of undercoating, I discovered that someone had installed a lift block on the left front spring—clearly not an approved military modification—so I removed it. Curiosity then led me to thoroughly clean the rear axle, and sure enough, there was another lift block on the left rear spring, which I also removed. Now my truck sits level (almost—the driver's side is still about 1/4" high). [Actually, these blocks are found on M37B1s and M43 ambulances, both of which have a door mounted spare tire on the driver side. The blocks compensate for the additional weight of the wheel and tire.—DHA]



For greatest effect, two additional spring leaves are longer ones.

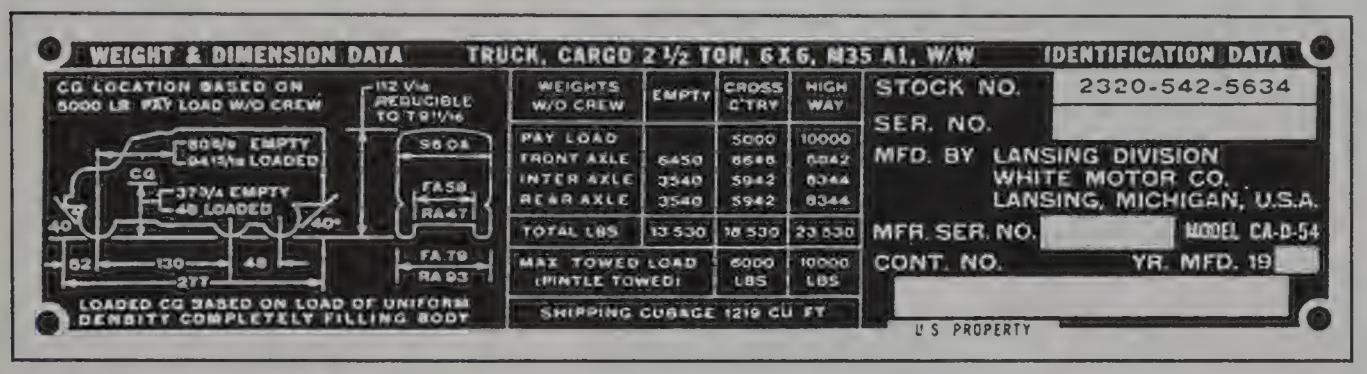
Another possible fix for front spring sag which I heard about from Tim Peterson (414-546-2433 eves) is the Rancho Add-a-Leaf kit #60112. [J.C. Whitney also sells an add-a-leaf kit for 1960's Dodge pickup trucks that ought to fit. —DHA]. If you've done something with your suspension, let me hear about it c/o *Military Vehicles* magazine or call me evenings at 704-843-1165, fax 704-843-6430.

Lifting blocks were only on left side of vehicle.

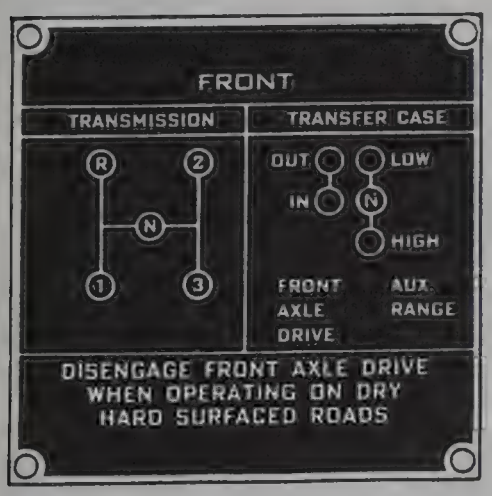
Refurbish That Old Data Plate

by Daniel Pinkham

To me, one of the most enjoyable aspects of rebuilding and operating my Dodge M37B1 cargo truck is the never-ending search for parts. Over the years here in North Carolina, I have discovered many "parts trucks" buried in weeds with trees growing through them, covered with cow manure and leaves, sunk deeply into the ground. Negotiating with a property owner for a free vehicle is always fun and can be as much of a challenge as extricating the vehicle from its resting place.



I have brought home rolled M37s, stripped M37s, and M37s so rusted that if not for the frame there would be nothing to hold the parts together. With each one comes a unique combination of joys and trials.



One by-product of this activity is a collection of M37 data plates, all of which were virtually unreadable.Nevertheless, being a cheapskate, I have attempted to restore many of them. In most cases this has proved to be a fruitless task, but for those that are salvageable, I have come up with a simple process you can use to restore and make them readable.

First, reject all plates that are bent, dinged, or have had the paint scratched off. Surprisingly, this is a situation in which paint is your good friend; my best candidates have been plates that I found concealed beneath 15 layers of paint.

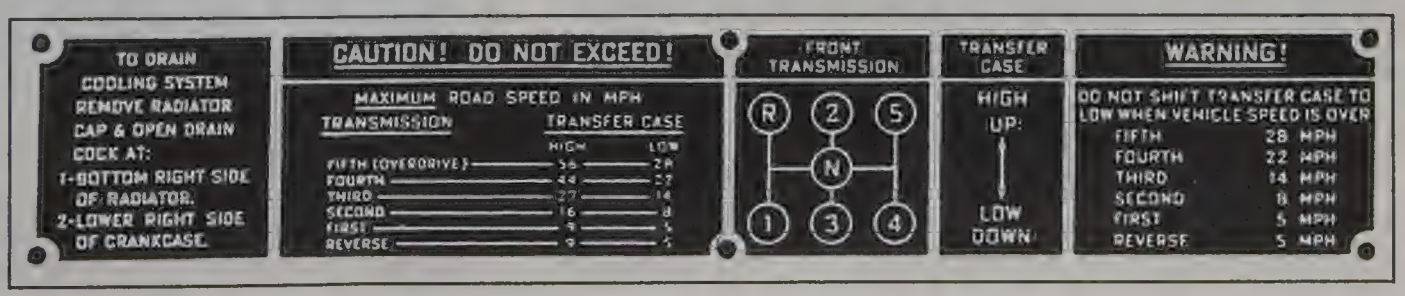
To start, carefully remove the plate from the mounting surface and apply paint stripper. Wait and let the stripper do its work. Carefully remove the loosened paint using your hands and fine sawdust (wear rubber gloves). Gentleness is the key here. Repeat until all layers of paint are removed. If you find mild corrosion on the aluminum plate, rub in DuPont 225S aluminum acid etch with your fingers. Rinse thoroughly and let dry.

Next, paint the plate with one medium coat of fast-drying flat black lacquer and let it dry. Using 600 grit sandpaper on a sanding block, lightly scuff the flat black paint from the high spots. Don't let the sandpaper load up with paint dust. Use light pressure and one-way strokes, and blow off the sanding dust after each stroke.

If your plate is slightly deformed and you find that you can't use a sanding block, you can use a pencil eraser, rubbing the eraser over each letter. This tedious process must be started shortly after painting while the paint is still soft. Plan to allot about three pencil erasers for each data plate.

WILLYS
NOMENCLATURE TRUCK ¼ TON 4 X 4
SUPPLY ARM OR SERVICE
MAINTAINING VEHICLE ORDNANCE DEPT
MAKE AND MODEL WILLYS MB
SERIAL NUMBER:
GROSS WEIGHT LBS
MAXIMUM PAYLOAD 800 LBS.
MAXIMUM TRAILEDLOAD 1000 LBS.
DATE OF DELIVERY -
RECOMMENDED BY MANUFACTURER
OCTANE RATING OF GASOLINE 68 MIN.
S.A.E. GRADE OF OIL BELOW 32 F USE 10W S.A.E.
S.A.E. GRADE OF OIL ABOVE 32 F USE 30 S.A.E.
PUBLICATIONS APPLYING TO THIS VEHICLE
PARTS LIST
TECHNICAL MANUAL T/M

Once you are happy with the look of the data plate, use a tack rag to clean it, and it coat with two or three coats of clear lacquer. This gives a nice gloss and keeps the aluminum from corroding. After it is completely dry, pop rivet the plate back into place on the dashboard and, voilà, your vehicle is one step closer to perfection.



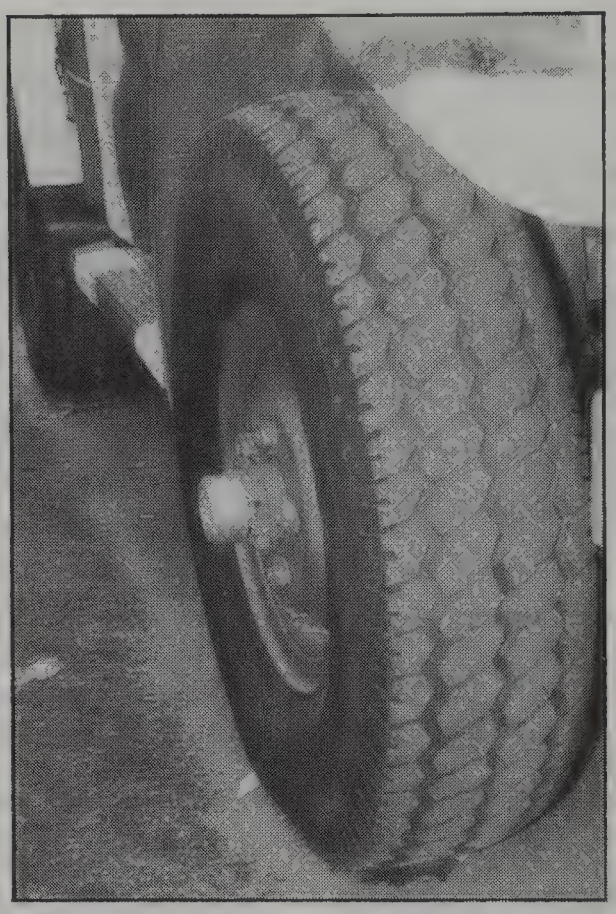
Denman Coyote A/P Tire

A great 9.00x16 alternative for M37 and M715 owners

by David H. Ahl

Although I installed a set of five Denman Coyote all purpose tires on our M37 project vehicle last summer, August 3 to be exact, I had put off writing this article about them until I had a chance to see them perform in the snow. But as of mid-March, with one of the warmest winters on record nearly behind us, I despaired of ever seeing any snow in these parts. However, a late season snowstorm dumped over 6" of snow on us the night of March 14, so that little problem was solved.

An M37 or M715 from the factory mounts a 9.00x16 8-ply bias-ply non-directional (ND) tread tire with a tube and a flap. Inflated to the recommended 40 psi, the ND tire has a 35.2" diameter and 110.6" circumference. Tread width is 7.9" and section width is 10.1". A new military replacement tire sells for about $120. But that ND tread doesn't put much rubber on the road. If most of your driving is off-road or if you drive your vehicle to only a few parades each year, the military ND tread is probably okay, but if you use your vehicle at all, a significant part of your driving will probably be on paved roads. On the highway, an ND tread is only about as wide as a bicycle tire (really!) and at highway speeds your vehicle will wander all over the road, a fact to which Betsy will attest, having driven behind me for many miles on Interstate 80.



The Coyote A/P tread is quiet on the road but aggressive on mud, snow, and off-road trails.

Until recently, if you were looking for a replacement 9.00x16 tire with an all-purpose tread for your M37 or M715, your choices were few indeed: McCreary Condor Superlug LT18E ($130 from Wallace Wade), Michelin XCL (for $285 each if you can find them), and Power King (for $130, made by Lee or Kelly, nobody seems sure, but it doesn't matter since they're no longer made). Denman makes several off-road oriented tires in similar sizes for sale under other brand names: Super Swamper TSL 13/36-16 ($159), Super Swamper TSL Steel Radial 36x12.5R16 ($156), Ground Hawg 305/85R16 ($135), and Buckshot Gumbo Mudders 305/85R16 (bias $143, radial $149), but these are aggressive tires meant for serious off-roading. Then, about a year ago Denman introduced the radial Coyote A/P ($135) in five large sizes including 305/85R16. Currently, the exclusive distributor for these tires is National Tire & Wheel.

If you're not familiar with metric tire sizes, the first number, 305, is the section width in millimeters (divide by 25.4 and you've got it in inches, 12.0"). The second number, 85, is the ratio of the sidewall height to the section width, and the third number, 16, is the rim diameter in inches. So the section width (12") x the ratio (0.85) = section height (10.2") x 2 + the rim diameter (16") = 36.4" diameter of the tire. This is about 3% larger than the 35.2" diameter of the military 9.00x16 ND tire, so at an indicated speed of 33 mph, you'll actually be going 3% faster, or 34 mph. Tread width of the Coyote is 9.1" compared to 7.9" for the military ND tire.

There's always a question about mounting a "different" tire on the military split rim. The bead angle of the military rim is only 5°, and some people will tell you that a civilian Denman or McCreary tire won't mount correctly. I confess that I haven't aired down to 15 psi, but at normal pressures I haven't had any problems with the bead lock leaking.

Although the Coyote is only slightly higher (about 1½") and wider than the military ND tire, it looks considerably bigger and it draws a lot of positive comments from other MV owners.

When *Four Wheeler* tested this tire (on a lifted TJ Wrangler) they said it was tall but not very wide and noted that "besides looking a bit militaristic, by design this shape offers a greater contact pressure compared with wider flotation tires, which helps increase on-road, all-weather performance." I couldn't have said it better—hey, it looks military but it performs great. Incidentally, the Coyote is a 6-ply tire whereas the military ND tire has 8 plies, but I haven't noticed any excess sway or wander in cornering.

Bear in mind if you get these tires, they are radials and you *must* get radial tubes to go along with them. You also should continue to use flaps with your split rim wheels. It took Service Tire Truck Center a few days to come up with the correct size radial tubes with long bent metal valve stems ($15 ea) and they used my old flaps.

Multi-Pronged Test

We got a chance to put the tires through their paces in four important situations: sustained high-speed highway driving, regular driving on paved roads, serious wet weather, and snow. Although we did a bit of off-roading, for that part of the evaluation we're relying on our friends over at *Four Wheeler*.

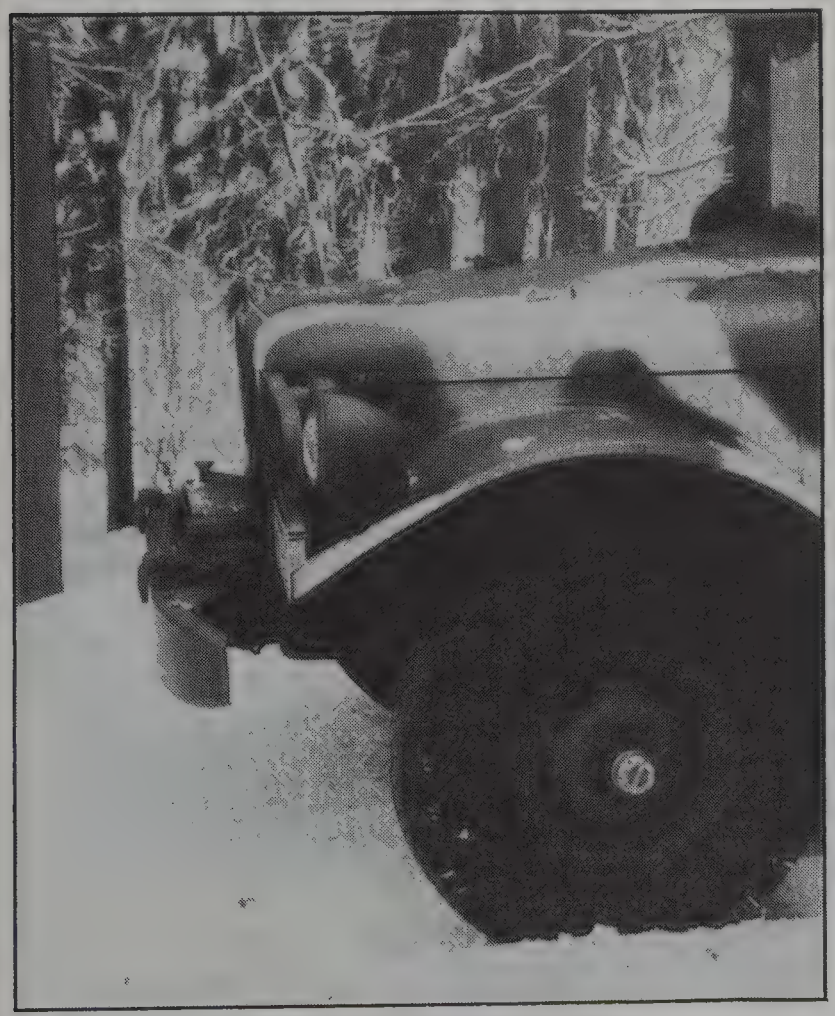
The first thing I noticed when the Coyotes were mounted was that the M37 stopped wandering. I could hold the steering wheel in one position and the truck would go in a straight line. It sounds

so simple, but anyone with an M37 knows the arm-and-shoulder fatigue of a long drive. Secondly, it steers easier. You'd think that with just the width of a bicycle tire in contact with the pavement (the ND tread), the truck would be easy to steer, but it isn't. Don't ask me why the Coyote with 8" across in contact with the pavement is easier to steer, but it is.

No one would ever accuse the M37 of being a quiet vehicle—good grief, every molecule of the vehicle is a miniature rock band as you pound along the pavement—but, believe it or not, it is noticeably quieter with the Coyote tires. Okay, it's a far cry from my Camry, or even my GMC Sonoma, but the noise really is more subdued than with the ND treads.

On the 160-mile round trip to Tobyhanna, Pennsylvania, in August, I got a chance to use the tires on a variety of road surfaces: Interstate highway, a 7-mile construction zone of grooved concrete, and a fair distance of narrow two-lane blacktop. In the past, narrow roads gave me the jitters because I was never sure when the ND treads might decide on their own to take a little off-road excursion, like into a fence or over an embankment. The Coyote treads gave me the confidence to drive in my own lane instead of down the center of the road.

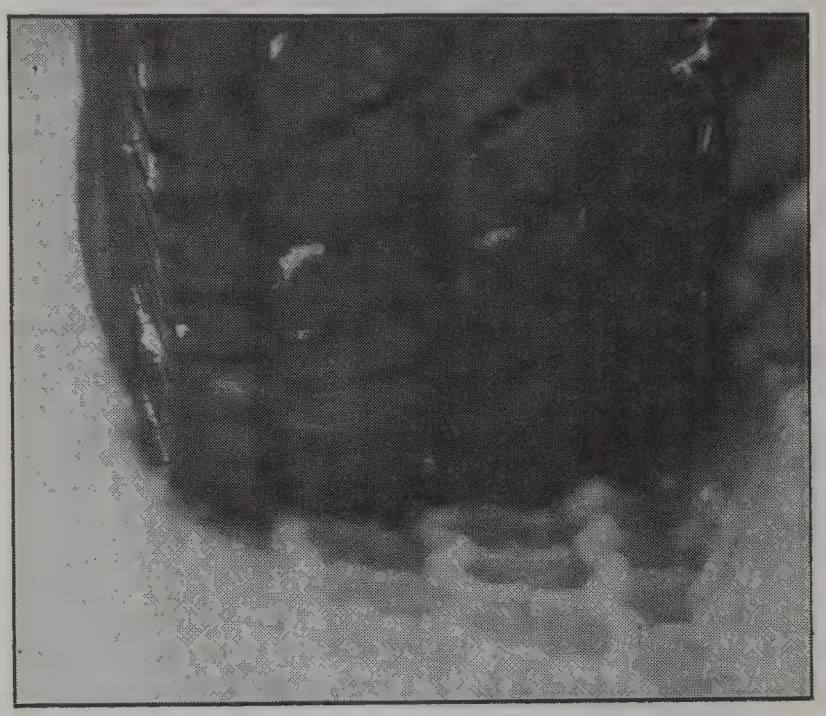
Rain, ah, rain. We had a nice sunny morning for the Mendham Labor Day parade and then I drove over to my in-laws' place for a picnic. The clouds started moving in at 2:00 p.m. and at 3:00 p.m., I left in an effort to get home before the rain. I didn't make it. Moreover, it rained not just buckets but swimming pools. To make matters worse, I had decided to take the shortcut, a narrow twisty road over a very steep hill. By the time I got to the top, there was already serious flooding; we're talking 1" to 4" of water cascading along, turning the road into a torrential mountain stream lined with slippery asphalt. The bottom of this road ends in a T intersection with a busy state highway. Gritting my teeth, I set off, and although I never took my foot off the brake pedal, I actually began to relax as I realized that the tires were holding the road and taking the truck where I steered it.



We venture out into a few inches of late season snow.

The worst stretch was actually Indian Head Road, then torn up for the installation of new sewers, but I just left the truck in second and inched along through water-filled potholes, into muddy trenches, and across heavy steel repair plates. Although it picked up a heavy coat of mud and grime, the truck behaved predicably and got me home without incident.

To be honest, the late spring snow didn't last long enough for me to give the tires a serious workout. Nevertheless while it wasn't the Rockies, I determined that the tires provided good traction and even though it was a wet, sticky snow great for making snowmen, the tire grooves didn't pack up at all. There was virtually no tendency to slip and slide, and had I had a plow blade, I could have gone anyplace with that baby.



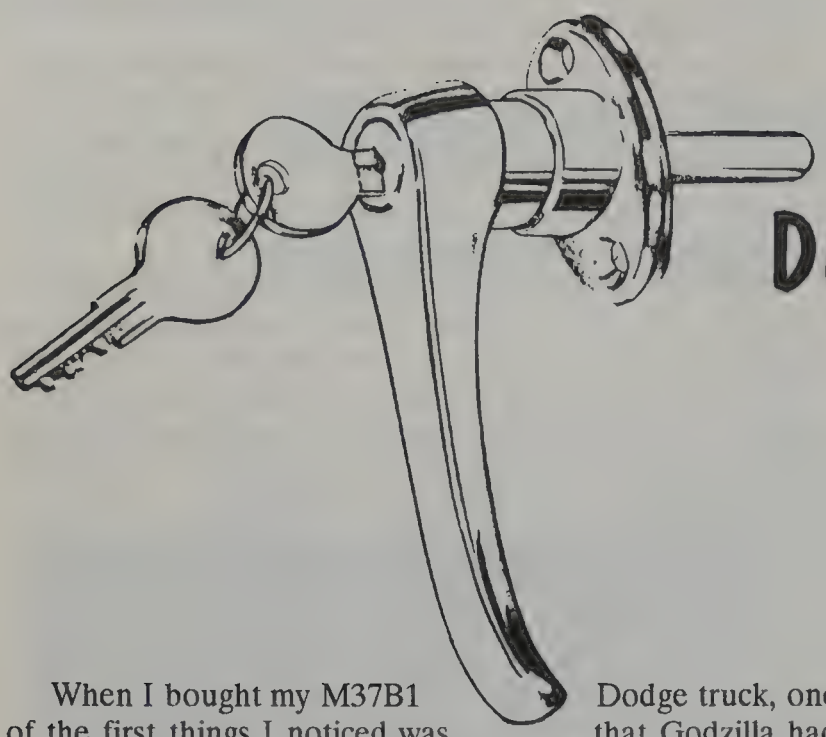
Hardly any snow at all packed into the Coyote tread.

As I said for the off-road part of the evaluation, we're turning to Ben Stewart at *Four Wheeler* who said in the June 1998 issue, "at our Malibu Test Facility, the tires were able to pull our TJ up and over the top of the toughest hill climb once they were aired down a bit.

"After some testing, we decided that rocks were not this tire's strongest suit. Though the actual tread conformed to the rocks, the square shoulder of the tire didn't allow the sidewall to wrap around obstacles as much as some other tires we've used. In spite of this, the Coyote's 9" tread width actually did quite well in light mud. This is due to the large channels in the center of the tire that we noticed provide an easy escape route for the goo. However, this isn't a true mud tire; in deep gumbo, even with a lot of speed, the decidedly all-terrain tread repeatedly packed up."

In summary, the all-purpose Coyote is a major improvement over the military ND tire for highway use, especially in the rain or snow. If most of your driving is off-road and you like to play in the gumbo, then you're probably better off with the ND tread, but if you're looking for a good all-purpose tire with a highway emphasis, the Coyote is the way to go. Moreover it's quiet (which will be appreciated even more by M715 owners than by M37 owners) and looks like it came right off a HMMWV.

Source: National Tire & Wheel, Dept. MV, P.O. Box 391, Wheeling, WV 26003, Orders 800-847-3287, Questions 304-233-7917, Fax 304-233-2286.

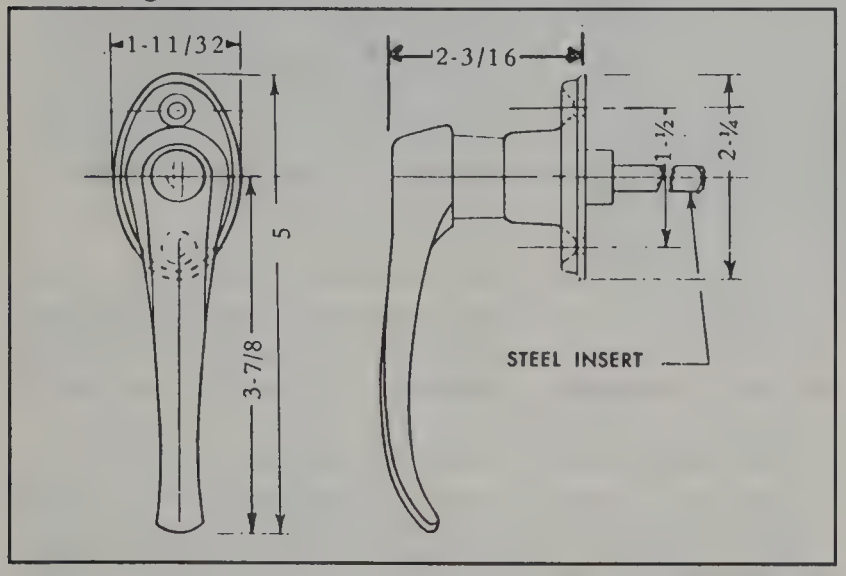


The Key to Success: Door Locks for Your M37

by Daniel Pinkham

When I bought my M37B1 Dodge truck, one of the first things I noticed was that Godzilla had been using the exterior door handles as bottle openers. This, coupled with the fact that I planned to use my truck for trips to the grocery store, malls, and other places where it would be left unattended, got me interested in finding inexpensive locking door handles.

After searching around, I finally found suitable handles at Piedmont Equipment Co. The measurements are shown on the catalog illustration below.



Installation of the door handle is relatively painless. Remove the two screws that fasten the old exterior door handle flange and pull the unit straight out. The square shaft on the new handle is too long, so make a careful measurement of your old one, cut the new shaft to the proper length, and deburr the end. I found that a cut-off wheel did a cleaner job than a hacksaw.

Next, measure the interior round base of the handle that fits into the door. Take a large Unibit or a taper reamer and enlarge the door hole to match. This allows the flange to fit flush against the door.

The original screws that hold the flange are 10-24 ⅝" oval head. If your old screws are in good shape, use 'em. Otherwise get new ones, but you may have to settle for flat-heads; oval head screws are tough to find. The countersunk holes in the new flange are on the same 1½" centers as the old one.

At this point, you can simply screw the handle on, but I recommend using a gasket or sealant of some sort. I like GE Silicone Sealant II. To apply the sealant, loosely screw in the flange and put masking tape around the base. Then remove the handle assembly and lay in a ⅛" layer of silicone sealant, smoothing with a body filler spatula. When cured, this becomes your handle gasket. Let the sealant dry, install the handle, remove the masking tape, and carefully trim off the excess cured sealant.

The handle is chrome-plated which, with my bright blue truck, is just fine. However, if you want to retain the original military look, mask off the lock and beadblast it to bare metal. Fine sandpaper would probably also work. Then prime it and paint it olive drab.

Although not identical to the original door handle, this replacement is close enough to satisfy me. I realize that a determined thief with a screwdriver and hammer could probably break this lock; it serves primarily to keep honest people honest and kids from climbing into the cab and taking the truck out of gear. (Yes, I once saw a small airplane destroyed by a truck set loose in this way!)

So for about $15 and an hour of work, I can now limit who gets into my truck when I am not around. After all the work I put into rebuilding my M37, I like that extra feeling of security.

Resource:
Piedmont Equipment Co., 401 West 32nd Street, Charlotte, NC 28233. Phone: 704-372-3450, fax: 704-375-1748, order line: 800-438-4120.

The M37 replacement handle is part no. 072002046 (Mfg. #L-204R), price $6.96 each plus shipping & handling.

Editor's note: the Piedmont catalog has some other interesting items that you might want to consider for your M37 or other military vehicle. Here are some ideas:

✘ Stake rack connectors. The corner connectors on page 223 (#190091020) look mighty similar to the original M37 front stake bed corner clips for only $1.53 ea.

✘ Eye bolts. Part no. 190072710 on page 226 is virtually the same as the one for M-series bed safety straps, $4.01.

✘ Hood catches. Can't find NOS hood catches? One of the ones on pages 110-111 will probably fit your vehicle, $3.45.

✘ Hinges. A huge selection on pages 175-197.

✘ Reflectors. Standard military size aluminum reflector, red (#640347210) or amber (#640347220), 84¢ ea.

M-Series Electrical Conversion: 24 Volt to 12 Volt

(or How to Run Your Dodge M37 on 12 Volts)

by Daniel Pinkham

In this article I'll try to burn off some of the fog regarding 24 volt to 12 volt conversions and shed light on various ways I have solved problems. My first voltage swap attempt was part of a rebuild of my 1954 M38A1 Jeep. It was very enlightening and, although crude, turned out to be a shining success. [Okay, no more puns.—Ed.]

This article will focus on how I converted my 1962 M37B1 Dodge Cargo truck to 12V. Although you may own a different M-series vehicle, you can probably pick up some tips from my experience. Incidentally, I dropped a diesel engine in my truck and made some other non-standard modifications; my not keeping it original is no reflection on dedicated vehicle restorers, whom I greatly respect, but rather is dictated by a limited budget and the need to use my truck daily.

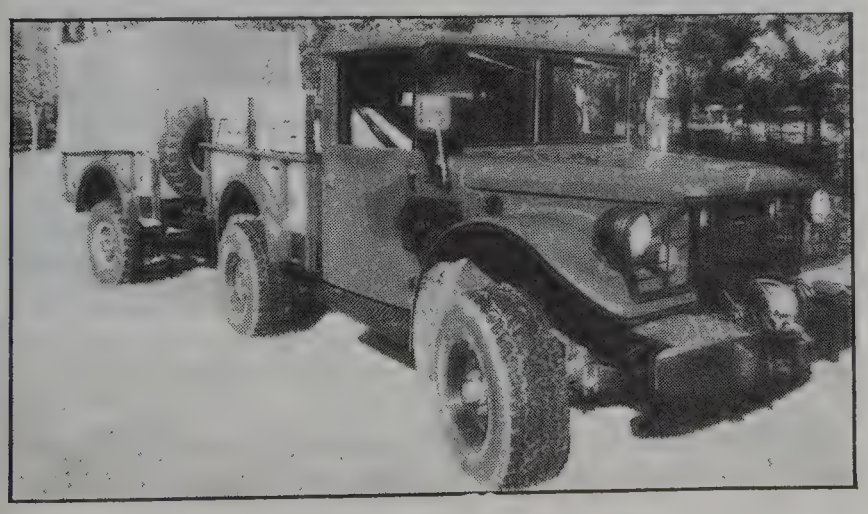
General Comments and Ignition

Before getting started on the voltage conversion, I recommend that you pick up a copy of the booklet, *Army Vehicle Parts Guide*, available from Portrayal Press. This 60-page booklet has charts and interchange tables on most WWII and postwar vehicles. Pages 12-20 list the electrical parts (ignition and lights) for every military vehicle series (6, 12 & 24V). It also has many cross-reference numbers which are helpful when trying to obtain replacement parts.

When replacing parts, there are many possible substitutions. For example, some ignition lead parts are similar to aircraft ignition leads. If you live close to a small airport, ask the mechanic if you can take a look through his junk box and you may find some usable items. Similar vehicles are another source; on my M38A1 I elected to use similar parts from an early model CJ5.

Remember that switches (for lights, ignition, radios, etc.) are not affected in any way by stepping down from 24V to 12V. They do not need to be changed unless they have high resistance due to pitting or corrosion (try cleaning them first).

You must, however, change all of your light bulbs to 12V. Pages 21-23 of the AVPG give excellent charts on light bulbs.



[If you have a Newark Electronics catalog, you'll find it equally helpful.]

If you want to install turn signals, the article by Dave Christel on pages 24-25 of the AVPG is a "must." This article in combination with an Abex Signal-Stat turn signal unit and my wiring diagram makes 12V turn signal installation easy!

The M-Series wiring codes on pages 26-31 of the AVPG will help you avoid some frustration as you try to trace out a circuit. On the other hand, the wiring diagram can also send you down a blind alley depending on how your vehicle was "field modified".

Starter and Generator

If your starter is in decent condition, then it is worth having a qualified shop convert it to 12V. If it's in poor shape or you can't find a shop that can do the conversion, then you'll have to buy a 12V replacement from a vendor such as SECO. One advantage to this is that the replacement will have a starter relay and button (no, I do not miss the foot starter on my Jeep).

I also added a standard keyed ignition switch with a spring loaded start position and an accessory position (available from parts houses such as NAPA). Connections on the switch back are well labeled for ignition coil, starter solenoid, and power for everything else.

Remove your 24V generator and use it as a boat anchor. Vintage Power Wagons sells a 12V alternator conversion kit for the M37. Alternatively, visit your local auto parts store and purchase a one wire 12V 60- or 100-amp alternator with an internal regulator. A 100-amp alternator should meet all of your future power needs unless you plan to use your truck as a welder or want to install a stereo that can also serve as a community PA system.

Talk with your parts man about your engine speed and he should be able to match you up with the correct diameter pulley (bring in your old belt so he can match belt width to pulley groove). Unless you are handy with metal and a torch, you may need to get an alternator mount fabricated (my M37 has a homemade mount, while my M38A1 uses some of the original generator mount after a heat & beat modification). Make sure the drive and alternator pulleys are in alignment and use a piece of cord wrapped around both as a belt sizing tool. Use the heaviest gauge electrical cable you can get to connect the alternator output stud to the battery stud and the starter solenoid.

Wiring

After 35 years the original wiring on my M37 looked like family night at an Italian restaurant. If yours looks the same, you have two options: buy a new NOS or replica harness or

make your own.

NOS and replica harnesses are nice for replacing existing, stock wiring. On the other hand, they are somewhat costly. Also, if your vehicle already has some modifications or additions, or if you intend to make some yourself, an NOS or replica harness isn't going to have the needed wires or connectors and things can get confusing mighty quickly.

Before you start replacing a harness, make sure you know where everything goes. You may have to use a multimeter to sort out some connections if your old harness crumbles in your hands.

For my M37, I made my own harness. Electric supply houses and auto parts stores sell multi-conductor hookup wires in a rubber jacket that can serve as the basis of a custom fabrication. These cables typically consist of 3, 5, or 7 stranded 16- or 18-gauge wires, individually insulated and color coded, all surrounded in a thick black rubber jacket. This becomes your core harness.

By cutting back the black rubber you can peel out each individually colored wire, route it to the appropriate light or instrument and strip the end for a terminal. An ideal application of this is the harness that runs back to your tail lights. For example, in my wiring diagram it would be wires 21A, 22A and 23A (a three-conductor cable).

Don't expect to find a suitable cable for every wire run. For short runs with lots of wires coming in and out of the bundle it is easier to zip-tie individual wires together and make up a bundle. Done neatly the end result can look very professional. I transfer the military number tags to my new wires to aid in future troubleshooting. For my connectors, I use insulated spade or ring style terminals applied with a good crimp tool (not one of those $2.99 el cheapo specials).

Any dash instruments that you want to keep electric can be replaced with Stewart Warner 12V units. Don't panic about the fuel transmitter! Buy a SW universal fuel tank transmitter that matches your new 12V gauge and use your old 24V transmitter as a pattern to match up depth, float arm length, and float throw. Of course the screw holes won't fit exactly but that is why we have drills! Use your old transmitter as a pattern and drill/enlarge holes in the new transmitter mounting plate until it fits. Do this someplace other than near your open fuel tank!

Lights, Lights, Lights

Using the charts in the AVPG or a Newark catalog most lighting changeovers should be a straightforward swap. By changing the headlight connector to the newer three prong style you will have more sources for 12V headlights. Your new electric SW gauges should have internal lighting. Steal power from the circuit that runs your existing panel lights and change the three bulbs that light up your speedometer and high beam indicator to 12V ones (old style panels take #67 bulbs and new style panels take #53, #57 or long-life #1895 bulbs).

In civilian life, there is little need for a blackout light, so I changed mine to a GE 4415 FOG tractor fog light. This is a simple operation: remove three screws that hold the B/O ring in place, remove clips and bulb, change the wire connectors to a ring style, and reassemble. This fog light provides more than adequate illumination for night winching operations; now I no longer have to run all my headlights and blind myself.

Fig. 1. A tractor fog light is mounted in place of the blackout light.

Turn Signals

Adding turn signals was the most difficult, but also the most fun, of all my electrical projects. The wiring connections, colors and "how to" are all explained in Christel's article. [Also see references at end.—Ed.] My wiring diagram color code for the turn signal switch should answer most questions. Note that I changed the taillight wiring and numbers to allow for a trailer plug in the future.

Because I wanted large tail/brake lights with side markers and a license plate light, I simply bought a trailer lighting kit at Walmart. Color coding is industry standard so just follow instructions. On the front however, I did not want to change the appearance of the vehicle, so I modified the lights, changing from the oval and slit cover to a full lens. To do this, I removed the light face center on a lathe, cut a slight groove into the remaining ring, and glued in a new plastic lens (NAPA 680-2282 for red and 680-2281 for yellow) with epoxy (Loctite DEPEND no mix adhesive). Internally I repainted the housing in refrigerator white, removed the center light separator and snapped off the two aluminum tangs (Fig. 2).

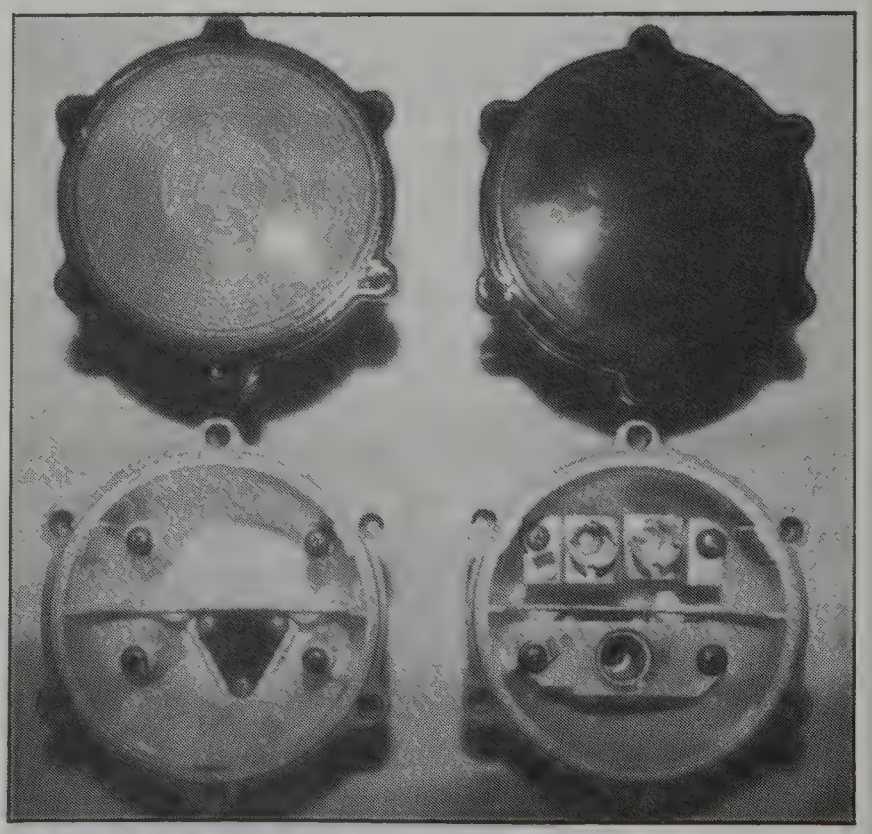


Fig. 2. Clockwise: Front turn signal/parking light (amber), rear (red), original M37 mounts, gutted mount ready for new internals.

At this point I can go one of two ways. I prefer to replace the rotted bulb connector internals with "Au-Ve-Co 5220"

single large wire lead pigtail connectors, install bulbs (#1073 for turn signals and #67 for parking lights) and put together my wire harness. Alternatively, you can make a square mount plate and install a NAPA LS6241 light socket with a two point contact bulb. Either way, it makes a sharp-looking functional change.

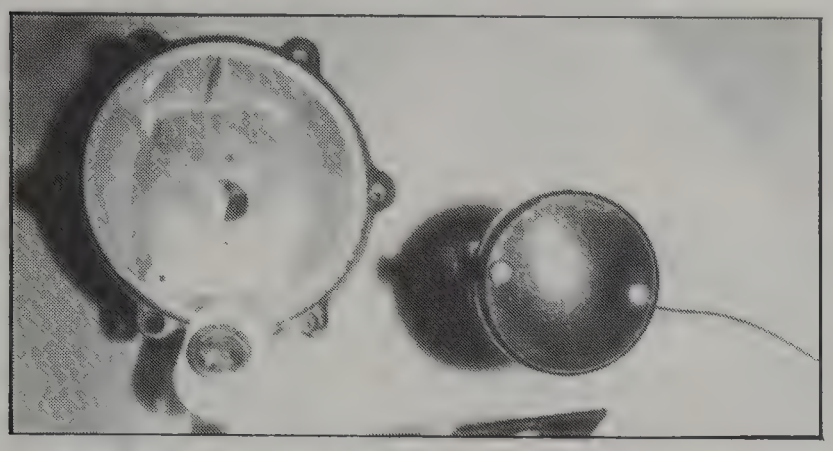


Fig. 3. Left: Light housing with plate for new socket (at bottom). Right: smaller taillight on later M37s.

The small tail light used on newer M series vehicles can also be modified using the same approach. Be careful: lathe cutting the red lens to size is tricky and scared me witless when it flew out of the cutter. Use a #1156 bulb in this unit. [I have several of both the large and small units (lens or complete to partial assembly) to sell/trade.]

Auxiliary Bus Bar

To add other accessories, I recommend installing an auxiliary fused bus bar. These are available at auto parts stores for multiple fuses. Just cut the plastic bar to the number of circuits you plan to have and find a convenient installation location under the dash panel (I mounted mine on the left sidewall). I connected my bus bar after a keyed heavy duty battery switch but before the original lever ignition switch. This allows me to run wipers, heater fan, and radio without putting power to the coil or electric fuel pump.

I took my lighter connection directly off the battery so I can run an electric camper cooler through the lighter without leaving the key in my truck.

My M37 has a factory hardtop so I mounted a dome light overhead and a speaker in each body tub pillar behind the seats. The radio/cassette player is inside the top of my glove box. My radio antenna is a dual use 15" rubber whip with a splitter; one side goes to the radio and the other to a hand held CB. Basically, I have tried to add accessories that are in keeping with the basic look of the truck inside and out.

Windshield Defrost

My defroster for quite some time was a big absorbent towel, but it always ended up with these greasy black stains so I finally rigged up a defroster. From my local auto store, I bought a back seat heater that plugs into a cigarette lighter outlet. It has a small squirrel cage blower and measures about 5" wide by 6" deep by 1.5" high. I glued velcro to the top of the unit and along the windshield sill. Positioned vertically with the exhaust vent pointed up and toward the window, it blows enough warm air on the windshield to keep it fog free. When not needed, I store it in the glove box.

Heater

The defroster is not enough to heat your cab! My first attempt at heating my cab with a M15A1 heater core and 12V computer box muffin fan was an abysmal failure! I am currently investigating a 12V 25 amp ceramic heater (1,200 BTU) used in -20F temps to heat the cockpit of four seater airplanes as they fly up north. It is supposedly also available in a 24V 25 amp (2,400 BTU) unit also. When and if this works I will write a follow up article.

Windshield Wipers

I hate vacuum windshield wipers and I get annoyed by those cheap electric units (like I have installed on my M38A1) because they don't auto park. I dislike using a bathroom squeegee in the rain. And I've already mentioned the merits of a towel. However, I finally found a workable solution.

For each windshield side I purchased a marine grade wiper motor from Diesel Equipment Company in Greensboro, N.C. (800-222-7159). These units are made by United Technologies Motor Systems (#WWF12C18-720S) and are also available in 24V. I also bought an ANCO heavy duty adjustable arm (#44-01), a 12" wiper blade, and a UTMS wiper switch (#SW 581019AS) to control both wipers. Wiring diagrams are included in motor and switch boxes. I used the old vacuum system plumbing as my electrical conduit.

Location of the wiper motor is critical. If you misplace the hole you will not be able to utilize the full motor sweep and/or use a 12" wiper blade. First, you slide out each tilt window from the main frame. On each windshield, I drilled a 5/8" dia. hole 17.5" measured from the left inside of the frame and 3/8" down from the top outside of the frame. These are approximate measurements and you must custom try them. "Measure and adjust twice and drill once." Be careful as the hole will just nick the glass insert. Put the motor shaft through the hole and mark/drill the bracket hole on the left end of the motor.

Next you must make spacers to stand the motor out from the inside of the frame. The shaft spacer must have a cutout to clear the exterior hinge. This enables you to still tilt out the window insert. Trial assemble everything for fit and then fill every space with silicone sealant on final assembly to keep out water and prevent your inner channel from rusting out.

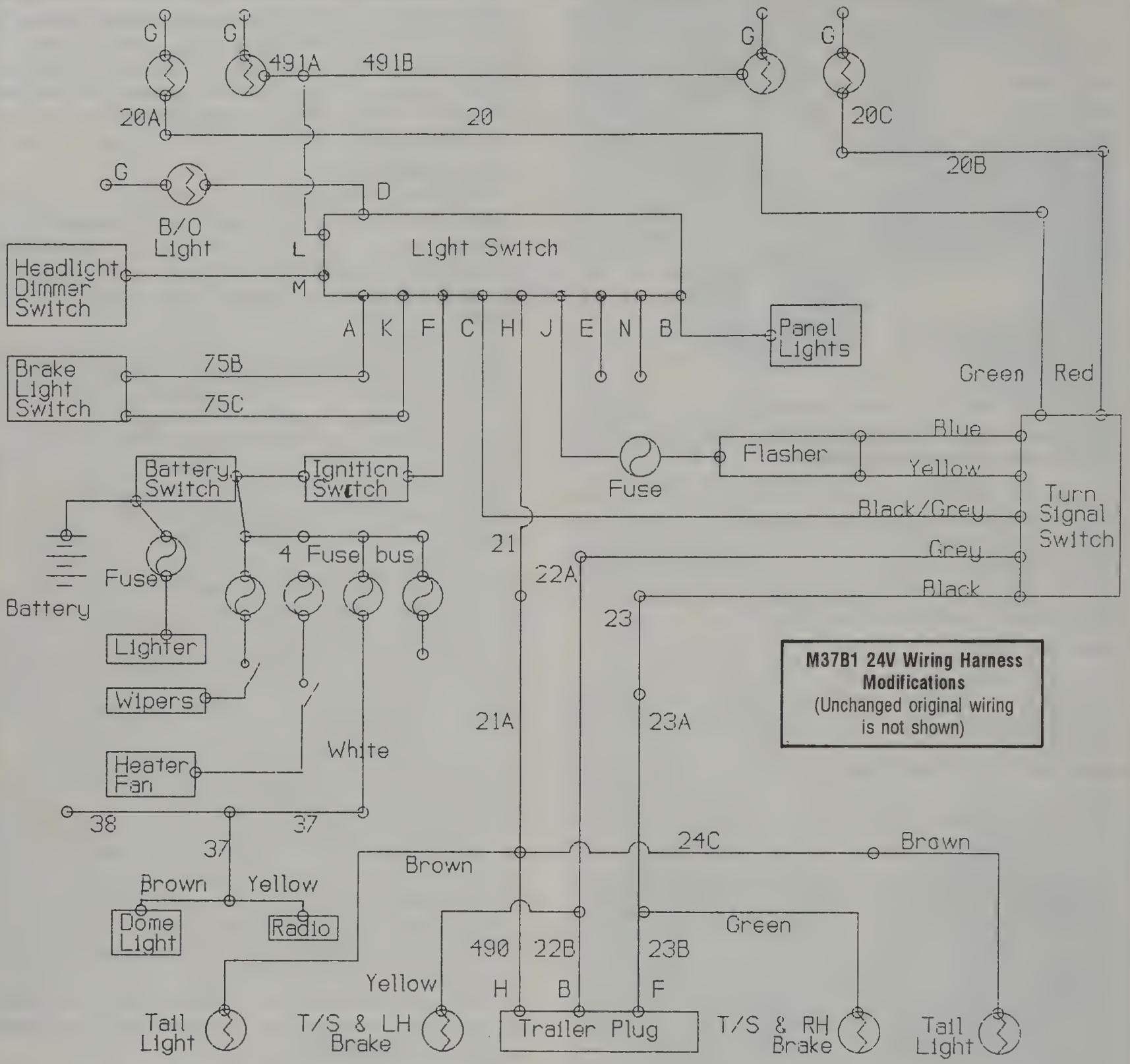
Last year I modified my windshield to a one piece solid type so my original frames with glass and holes already drilled are available for sale/trade. Anyone interested in hearing about my solid windshield modification?

Once the wiper motor is installed remove the gear box panel and change the pin setting to 120 degrees. Now close the panel, reinstall the tilt-out window and connectp the wires. By carefully adjusting arm placement on the motor shaft and arm length, you can set the wiper up to come very close to touching the left and bottom inner rubber window seal. This gives maximum window wipe of the blade with two speeds and auto park!

Conclusion

I've had a tremendous amount of fun over the years working on and modifying my M37. I am having even more fun using it! As you can see a 24V to 12V conversion is not really difficult. It just takes patience, perseverance and the willingness to make mistakes and learn from them.

Questions? Call me evenings 8 to 10 p.m. at home 704-843-1165 or send e-mail to DAN_PINKHAM@SIL.ORG.



M37B1 24V Wiring Harness Modifications
(Unchanged original wiring is not shown)

M37B1 wiring harness connector as it hooks into light switch (letter is plug pin, number is wire)

A - 75 Brake light power into master cylinder switch
B - 40 Panel Lights
C - 22 Brake lights to rear (originally 1 LH rear)
D - 19 B/O driving light (LH front fender)
E - 20 B/O parking lights (originally 2 front & 2 rear)—disconnected
F - 15 Power into all lights on switch
H - 21 Parking lights (originally 1 LH rear)—now both rear lights
J - New white wire for power to turn signal switch
K - 75A Brake light power after stop switch on master cylinder
L - 491 Front parking lights only (2)
M - 16 Dimmer switch for head lights
N - 23 B/O brake lights (originally 1 RH rear)—disconnected

Trailer Harness Plug connector

A - 24D ???
B - 22B LH Turn/brake
C - 24E ???
D - 90 ground
E - 21B Tail lights
F - 23B RH Turn/brake
H - 490 Tail lights
J through N - empty; not connected

Electrical system changes

Trailer Plug wires interconnected
21A + 21B - Pin "E" + "H"
22A + 22B - Pin "B"
Wires not connected to anything - 24, 24B

Locations of connectors on my M37B1

Under instrument cluster on firewall
Green T/S wire
20 + 20A
36 oil pressure - not connected, using mechanical gauge
37 & 38 Radio & dome light
400 connected to RH fender

Under diesel air cleaner inside RH fender
20B + 20C
21 + 21A
22 + 22A
23 + 23A
28 + 28A
18 to dome light and radio
75 + 75B
75C + 75A
400 not connected, see cluster note

LH inside fender
17 + 17C
18 + 18B
19 + B/O light
20 + 20A
25 + 25A (to horn relay, nonstandard)
36 oil pressure - not connected, using mechanical gauge
491 + 491A

RH rear tail
23A, 23B + green T/S wire
24C + Brown RH tail light wire

LH rear tail
22A, 22B + yellow T/S wire
24C, Brown LH tail wire + 490

References

Servicing Lamp Assemblies in M-Series Vehicles by Steve Turchet, *Military Vehicles* #7.

Adding Turn Signals to Your Military Vehicle (using Abex Signal-Stat unit) by Steve Turchet, *Military Vehicles* #23. Similar article (using universal kit) by Franz Wagner, Issue #29.

"Electrical Special Issue:" Rewiring an MB/GPW, Battery Isolator Switch, 24-volt connectors, *Military Vehicles* #31.

Restoring M-Series Wiring by Howard Bearse, *Military Vehicles* #32.

Broken M37 Axle

Ever since mentioning in the last issue that I broke my M37 axle, I must have received at least 20 letters, faxes, and e-mails from people offering 1) condolences and/or 2) a solution.

Proposed solutions: 1) wrap spring wire around a broomstick, shove it up against the axle stub, twist it until it tightens around the stub, and gently pull it out, 2) same thing but run insulated wire from the ends of the spring wire out along the broomstick handle and attach them to a car battery, thus making the wire coil into an electromagnet, 3) tape a very strong magnet onto the end of a broomstick and use it to pull the stub out, 4) spot weld several welding rods together to make a 3' length, run it through several corks or something to keep it centered in the axle housing, push the end against the axle remnant, connect the vehicle frame to one side of a MIG welder and the welding rods to the other side, weld the rod to the axle remnant, and then pull it out, 5) to avoid welding your gears together using method #4, run two parallel rods through corks in the axle housing, touch both of them to the axle remnant, and hit 'em with voltage from your MIG welder, 6) lift the opposite side of the truck up on a front-end loader to a 45° angle and shake the truck with the loader., 7) disconnect the drive shaft, take off the differential housing, and wiggle a wire inside to push out the axle remnant, and 8) take the whole darned rear end off, put it on its side, and whack it a few times with a sledge.

Mark at the local U-Haul rental truck repair place finally wound up using method #1 starting with a very small dowel which compensated for the remnant being broken off at a very elongated angle. It took five or six tries over 30-40 minutes, but the stub finally came out. We matched it with the axle and found, much to our relief, that nothing was left inside.

Several people have warned that simply removing the stub is not enough because metal shavings and particles can be left inside that can wreak havoc with your differential gears if you don't get them out.

M37 Common Tools and Accessories

According to the M37 Operator's Manual (TM-9-2320-212-10), there are three lists of items to be installed on M37s: installed, expendable, and troop installed. But the lists are all printed in different places. For reference, here are the items from all three lists in one place (consumable maintenance supplies such as oil and grease are not included).

Component Installed Items:

2590-473-6331	Bracket; drum inflammable liquid w/strap (installed on right front fender)
4910-357-5494	Bracket, tool pioneer equipment set 41-B-1925 (installed on tailgate).
4210-555-8837	Extinguisher, fire, w/bracket, hand.
4010-297-1815	Cable: Assembly winch w/clevis and chain, composed of 1 chain, winch cable, ½-in. link, 4-foot long with hook (installed on winch drum).

Expendable Supplies and Material:

5140-772-4142	Bag, Tool satchel (empty) 20¼ x 18¼ (in tool compartment, exterior, R or L side).
7240-222-3088	Can, Gasoline, Military: 5 gallon (in bracket on right front fender).
4010-473-6166	Chain, utility: 5/8" link x 16 feet long, w/hook, w 2/2 rear shape coupling end links (in tool compartment, exterior, R or L side).
5120-293-3336	Shovel, hand, general-purpose, round point open back (in bracket on tailgate).
7240-177-6154	Spout, can, flexible nozzle, 2½" dia, 15" long (in tool compartment, exterior, R or L side).

Troop Installed:

5110-293-2336	Axe, single bit: 36" w/handle, 4 lb (M37, M37B1) (in bracket on tailgate)
2540-054-0022	Chain, pneumatic tire: truck, single 9.00x16, Type TS (in tool compartment, exterior, R or L side)
5120-243-2419	Bar, socket wrench handle: ¾" dia, 30" long, Type A used w/wrench 41-W-3843 (in tool compartment, exterior, R or L side).
3940-609-8026	Block, snatch: wire rope, 5-ton working load, single 6½" sheave, w/swivel hook, ½" dia. rope (in tool compartment, exterior, R or L side).
2540-670-2459	Bag, pamphlet: cotton duck, 3 x 9¼ x 11¼ (under driver's seat).
Unknown FSN	Cask, water: thermos, spigot type, 3-gal cap., stainless steel lined w/carrying handles (M201, M201B1) (on top of body left front side).
5120-357-6106	Handle: jack, tubular, 27/32" dia., 20" long (in tool compartment, exterior, R or L side).
5120-254-6618	Handle, mattock, pick: 36" long (M37, M37B1) (in bracket on tailgate).
5120-233-6829	Jack, hydraulic, hand: self-contained, 3-ton, 9¼" closed, 16-7/8" extended, w/operating instructions (decal in tool compartment, exterior, R or L side).
5120-243-2395	Mattock, pick: w/o handle, 5 lb (M37, M37B1) (in bracket on tailgate).
5120-223-7397	Pliers, slipjoint: sight nose, comb. w/cutter, 8" long (in tool bag).
5120-234-8912	Screwdriver: cross tip, phillips type, plastic handle No. 3 size, 6" long (in tool bag).
5120-222-8852	Screwdriver: flat tip, plastic handle, ¼" flared tip, 4" long (in tool bag).
5120-293-2452	Wrench: double head socket, hex, 1-1/16" opening, 10" long (in tool compartment, R or L side).
5120-708-3302	Wrench: drain plug, straight bar, ½" square plug, 2½" long (in tool bag).
5120-240-5328	Wrench: open end, adj., single head, 15/16" jaw opening, 8" long (in tool bag).

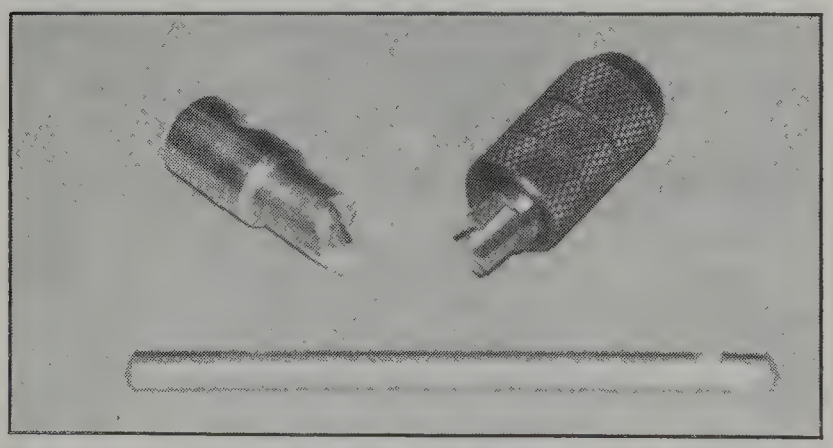
Must-Have Tools

by David H. Ahl

Incidentally, I don't often get up on my soapbox, but I can't emphasize enough the benefit of buying good tools and taking care of them. I remember when I was in 7th grade in 1950, I was finally allowed to ride my bicycle from my home in Malverne to the Sears store in Rockville Centre. My first purchase was a pair of Dunlap pliers (I couldn't afford Craftsman). I still have those pliers today and they don't have a speck of rust on them. A year later I splurged on a set of S-K sockets; guess which socket set I used on the M37. As I was able to afford them, I moved up to tools by Craftsman, Channel-Lock, S-K, Vise-Grip, Klein, Xcelite, and Crescent, most of which are still in my tool chests today.

Restoration work often calls for tools beyond those found in a normal automotive tool collection. Here's a list of those additional tools that I found to be invaluable in restoring my M37 (this does not include any specialized tools for bodywork or painting).

Tap & Die Set. You may need two sets, one for smaller sizes and one for sizes up to ½". When you remove rusty bolts, you'll want to re-tap the nut or bolt hole and, after wire brushing, you'll want to pass the bolt through a die. Also, if you mount new accessories such as a rear-view mirror or battery cutoff switch, you'll get a much neater job by tapping the new screw or bolt holes than by using self-tapping screws.



Rule: Don't use Chinese tools. Here's a tap wrench after trying to re-thread a ¼-28 hole with it—and I'm careful with my tools! Harbor Freight ignored my request for a replacement.

6" or 8" Bench Grinder with Wire Brush on one side. In restoring my M37, my wire wheel probably got more use than any other single tool. If you're going for perfection and money is no object, you can buy all new nuts, bolts, and washers. However, I found that 90% of the old bolts were reusable after a through wire brushing (all six flats of each bolt, the head, and threads). After wire brushing, throw 'em in some degreaser, dry 'em, and spray on primer followed by a color coat of paint. After reassembly, of course, they'll get another coat of paint. I used new washers and new nuts except for the largest ones—it's impossible to get the threads of an old nut clean and it just isn't worth the time and effort to wire brush old washers.

Screw Extractor Set. There will be many places where the only way to get out a screw or bolt is to slather the threads with Liquid Wrench and rust remover (for 24 hours), drill a starter hole, and then use a screw extractor. Using a screw extractor is the *only* way to get carriage bolts out of wood seats and side rails without destroying the wood. Don't even think about using cheap Chinese extractors; get a good quality American-made set by Greenfield or Chicago-Latrobe. Even so, I broke the #2 extractor of my Greenfield set. Unfortunately, Greenfield doesn't stand behind their tools like Craftsman does, and they refused to replace the extractor because they didn't feel that it was faulty. This is rather ironic since Greenfield actually manufactures Craftsman drill bits.

Heavy-Duty Vise and Sledge Hammer. To straighten out various parts, get yourself a decent 4- or 5-pound sledge hammer and a heavy vise with 6" or 8" jaws. Bumper braces, running boards, and heavy metal brackets just aren't going to submit to a 16-oz hammer in a 4" Wilton vise. Sometimes a torch helps too.

Rotary Carbide Bur. Sometimes called a rotary file, this is used to enlarge a hole in one direction (make it into an oval). Yes, I know that if things line up correctly, this should not be necessary, but we're talking about the real world here and things don't always line up. A quarter-inch cylindrical and three-eights cone shape should take care of most needs.

Deep Socket Set. You'll find many places on military vehicles where the bolt is too long to allow a standard socket to fully seat on the nut. Solve this problem by getting a set of deep sockets. Personally, I like 6-point impact sockets, particularly for disassembly of 50-year-old rusty bolts that occasionally necessitate standing or hopping on the end of a breaker bar.

Nice-to-Have. A good quality nut driver set with hollow shanks to deal with long screws. A set of C- or S-shaped box wrenches for getting into tight spaces. A torque wrench. One or two pipe wrenches in the largest sizes available. A really good automatic wire stripper. Socket extensions (3" and 6" are the most useful). Stubby screwdrivers. Telescoping mirror, magnet, and pick-up jaws. Hand riveter kit. Stripped head screw remover set (hardened tip screwdrivers). Razor blade scraper and box of 100 single-edge blades. Multimeter. Mini grease gun. Wire brushes (all kinds, all you can afford). Two sets of jack stands. Craftsman Robo-Grips (sensational!).

SECTION III

The 19 pages that make up this section of the book are reproduced from various U.S. Army publications. The first 13 pages are taken from various issues of PS Magazine (Preventive Maintenance Monthly). The next two pages are the lubrication order for the M37 and the last four pages are a reproduction of a little-known Modification Work Order for reinforcing the tail gates of all M37 vehicles.

BE YOUR OWN INSPECTOR . . .

CHECK YOUR ¾-TON TRUCK

Sliced thick or thin, equipment inspection is seeing if it's up to par.

On an item as big as your G741-series 3/4-ton truck, it takes time. Luckily, you can do it by pieces—a bit each day. It's real PM (Preventive Maintenance) too, because it helps you see things you might miss otherwise.

The only tools you need are pliers, screwdriver, crescent wrench, tire pressure gage and ruler or steel pocket tape.

You may be tempted as you go along to borrow a torque wrench or such and make a fix on the spot. That's bum dope—because the fault you find may be a sign of another fault you can't see. If you make a fix that doesn't do the whole job, you're just covering up evidence . . . and maybe heading for a good-sized breakdown.

It's right to huddle with your unit mechanic, though. He'll know the details, and he'll tell you right when you're in doubt. He'll expect your DA Form 2404 from you when you're through, too—which of course you'll fill out accordin' to your TM 9-8030 and LO.

Just put down the faults you do find, nothing fancy. They call it Inspect, Detect, Correct. The first two you do; the third one, unless it's something minor you can handle with the tools in your pocket, your unit shop genius takes over.

When you get to the underside, use a rack or ramp. Some stuff you have to look at from both ways, top and bottom—steering gear, f'rinstance.

Start where? Anywhere . . . like say you just walk up to where your truck's parked right now.

The **bold type** is for those real serious things. Get 'em fixed, but quick.

FRONT

GENERAL APPEARANCE — Rusty, dirty, dented; leaning to one side (could be a broken spring or U-clamp).

HEATER — (if present) Won't work, loose; clamps or hose cut, loose; screen missing.

BRUSH GUARD — Loose, bent, rusty; weight classification **missing** (FM 5-36, Ch 1), wrong.

HOOD SUPPORT LATCH (over top right of windshield) — **Missing, won't work,** bent, rusty.

HOOD — Hinge pins bent, broken; support latch socket **missing, loose;** holddowns **missing, won't work;** registration unreadable, missing (AR 746-5 and TB 746-93-1).

HEADLIGHTS, BLACKOUT LIGHTS, TURN SIGNALS—**Not working,** not adjusted; lenses **cracked, painted over,** clouded, dirty, waterlogged; blackout shield missing, not in place; **bare wires,** insulation frayed.

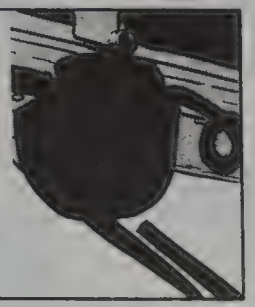
LIFTING SHACKLES — Stuck, **missing;** base **cracked;** cotter pin out.

BUMPERS — Badly bent, cracked; **unit markings** (AR 746-5 & TB 746-93-1) wrong, **missing;** bolts out, loose; clevis pin rusty.

MORE

In the CAB

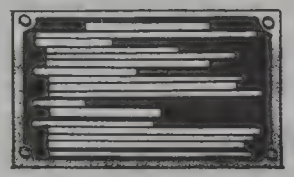
WINDSHIELD WIPERS — Jammed, **broken;** motor **not working;** manual handles missing; wiper rubber hard, streaking, cracked, gone; mount loose; **won't work.**



WINDSHIELD—Glass loose, crazed, or **clouded** enough **to obstruct vision** (driver's side); adjusting arm or lock rusty, stuck; seal torn; frame bent. Glass crack longer than 2 inches.

REAR VIEW MIRROR— Glass clouded, **broken;** supports bent, **broken;** won't adjust and stay put.

DATA PLATES — Missing, loose, painted over.



DOORS — Latches loose, driver's latch **sticking;** panels torn, loose; hinges bent, **unlubed; handles missing;** glass won't roll up or down; stops won't hold in all positions, drain holes clogged.

MAP COMPARTMENT—Trashy, dirty, leaky; **pubs and forms** (check your local SOP and TM 38-750) **missing;** flywheel housing fording plug missing; latch kaput.

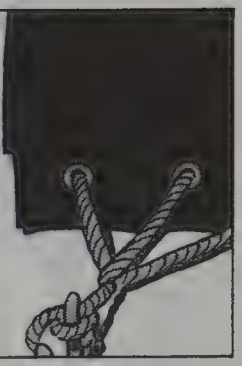
FIRE EXTINGUISHER— Seal missing, charge gone; handle broken.

SEATS — Regulator lever **stuck,** loose, **missing;** cushions torn, dirty.

FLOOR BOARDS — Dented, loose, unfastened, muddy, rusty, trashy.

STEERING COLUMN—Clamp broken, loose.

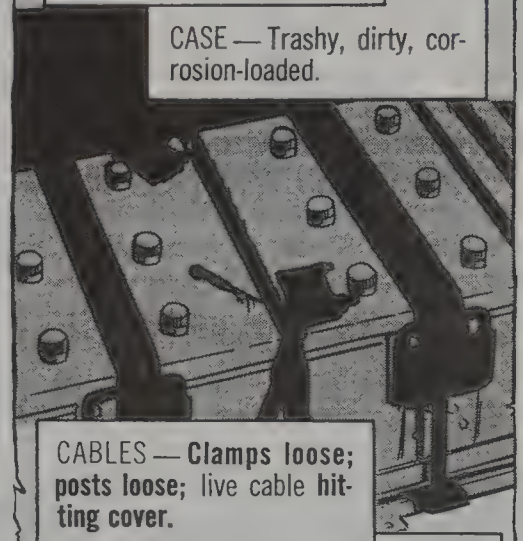
COVER—Cut, mildewed; straps sagging; seams **ripped;** canvas mounted with **open side of seam toward front,** eyelets **missing;** ropes frayed, missing; tarp hooks missing, badly bent, rusted, loose.



BATTERY COMPARTMENT

TOP — Hold-downs corroded, loose; cover rod, latch, or bolts bent or **missing.**

CASE — Trashy, dirty, corrosion-loaded.



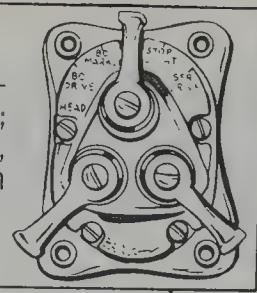
CABLES — **Clamps loose; posts loose;** live cable **hitting cover.**

BATTERIES — Caps **missing,** vents clogged, loose; **electrolyte not covering plates;** wrong specific gravity for climate (1.200 to 1.225 in tropics; 1.280 in temperate zones), tops punctured, **cracked;** cells dead, dirty, corroded.

MORE

OPERATIONS CHECK

LIGHT SWITCHES — Cracked, painted over; handles **missing,** loose, stuck, won't twork; dash lights won't work.



TURN SIGNALS (if present)—Mounted loose; indicator lenses broken, painted over; control sticking, loose, **wires exposed.** (See Paras 166-172, Ch 8 TM 9-8030).

SOME THINGS HAVE TO BE CHECKED WHILE ON THE RUN... SO, TO BE SURE DO A WORK-OUT TEST!

BRAKE PEDAL—Soft, loose, grabs; adjusted wrong (¼-in to ⅜-in free travel is right); brake **won't hold.**

CLUTCH PEDAL — Won't return, free travel wrong (should be about 1 inch); draft pad missing.

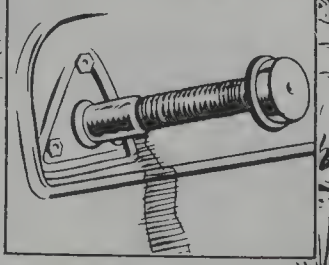
COWL VENT HANDLE — Bent, vent sticking.

HAND BRAKE LEVER — Bent; release sticking; **won't hold.**

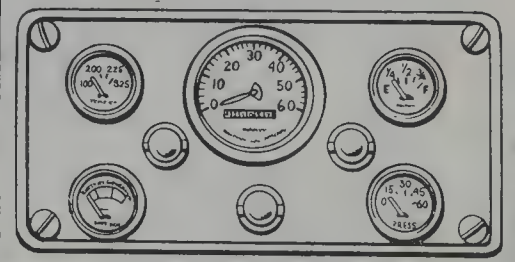
DIMMER SWITCH — **Won't work,** sticks.

ENGINE PRIMER (if any) — Handle stuck, won't work.

STARTER PEDAL—Jamming, loose, **broken.**



GAGES—Ammeter **not showing** charge; oil pressure below 40 PSI or **not reading;** water temperature over 180° or **not working;** fuel level **not showing;** speedometer jerking, unsteady, **not working;** odometer not totaling distance; dials painted over; covers cracked, missing.



HORN BUTTON—Sticking, loose; **horn won't work.**

HEATER CONTROLS (if present) — Switches not working, loose; **wires exposed.**

ACCELERATOR—Bent, sticking; fastening loose; boot torn, missing.

STEERING WHEEL — Loose, excess play; rust-corroded from inside, core **broken;** so badly bent it's unsafe to use.

PS MORE

UNDER THE HOOD

MAKE SURE YOUR HOOD SUPPORT'S HOLDING GOOD 'N' SOLID BEFORE CLIMBING UNDER THE HOOD. IF IN DOUBT, USE A ROPE OR PIECE OF WIRE TO TIE IT BACK--ANYTHING THAT'LL SAVE YOU FROM MEAT CLEAVER TREATMENT!

APPEARANCE — Engine greasy, dirty; braces loose, broken.

CAREFUL- KEEP HANDS AWAY FROM MOVING FANS!

FAN — Blades bent; rivets missing; belt frayed, loose, over-tight (½-in deflection is right); **hitting radiator or shroud.**

WATER PUMP — Shaft **wobbly; leaking;** unlubed.

CRANKCASE VENT — Loose, pinched, dirty; **clips missing.**

CARBURETOR — Base loose; choke or throttle **controls sticking;** linkage worn, not working easily, leaking.

DISTRIBUTOR — Dirty, loose in mount; spark plug cable connectors loose; primary wire lead connection loose; **cracked.**

OIL FILTER — Mount loose; dirty, leaking; cover loose.

REGULATOR — Cover loose, damaged; mounts loose; cable connections loose; bare wires.

CRANKCASE — **Oil level low** (below ADD mark) on dipstick; pressure sending unit (behind oil filler pipe) loose, **broken,** wire loose or frayed.

GENERATOR — Cable insulation cut, cracked, **wires exposed;** mounting loose, out of alinement; squeaking (don't try to lube — it's sealed!).

STARTER — Wire lead cracked, frayed; bolts or nuts loose; dirty.

FUEL PUMP — **Leaking;** dripping oil; loose on mount; case or base **cracked.**

FUEL LINES — **Leaking;** bent, pinched; loose. Fuel bowl dirty.

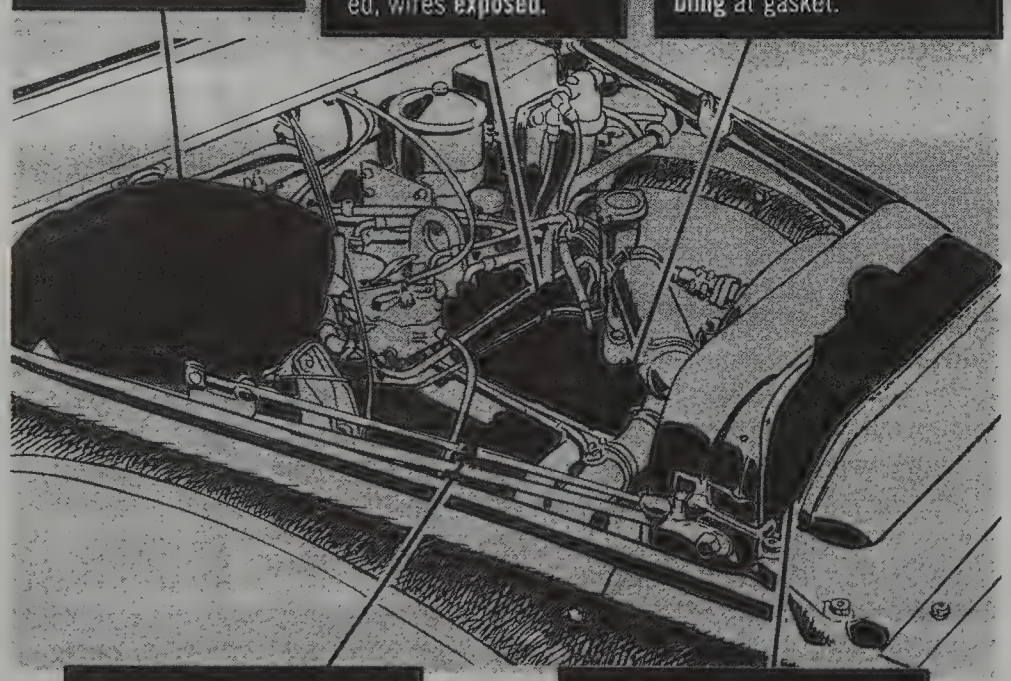
MORE

UNDER THE HOOD

AIR CLEANER — Nuts, cover loose; oil dirty; gaskets cracked.

SPARK PLUGS — **Cracked, loose,** dirty; connectors loose; cables frayed, wires **exposed.**

HEAD & BLOCK — **Cracked,** coolant or oil leaking; bolts, nuts loose; **hissing** or **bubbling** at gasket.



MANIFOLDS — Gaskets cracked; **flanges** or **body cracked, leaking;** loose; heat control valve not working.

RADIATOR — **Leaking;** hoses rotten, soft in spots, pinched; drain cock stuck; **coolant below top of core;** cap missing.

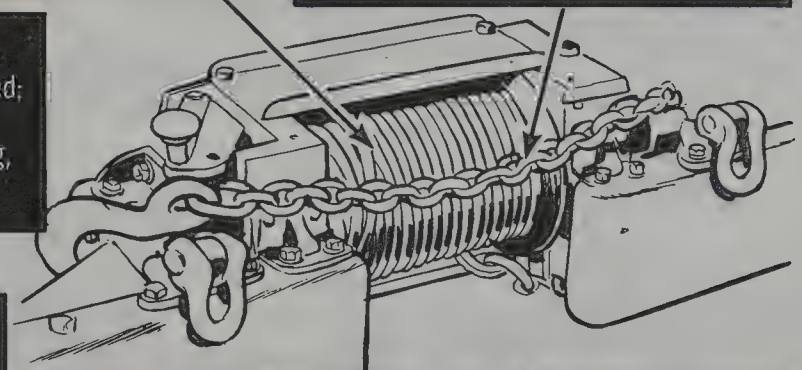
WINCH

If you have one, it's your sub that comes offa the bench to get you out of tight places . . . the extra-kicker that may not play much, but oboy. So scan—

CABLE — Unlubed, corroded (use fresh lubricant only); kinked, frayed; loose on drum; improperly wound; mud-clogged.

CHAIN — Hook loose; fastened wrong (Fig 27, Ch 8, TM 9-8030); links cracked, **broken;** hook spread, cracked.

DRIVE SHAFT — Dry, dirty, unlubed; cotter pin gone; shear pin missing, wrong.



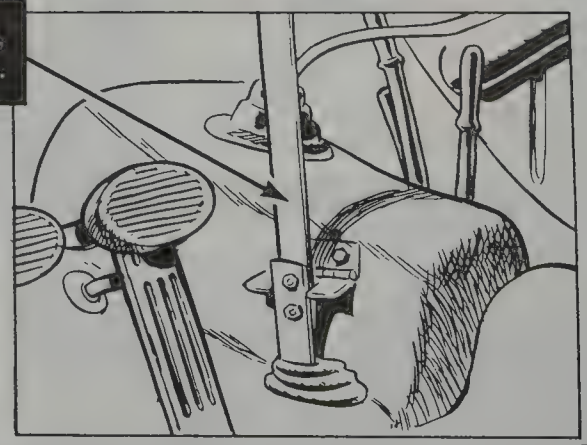
GEAR CASES — Seals leaking; lube level low.

SHIFT HANDLE — **Jammed,** not in engaged (hold-tight) position.

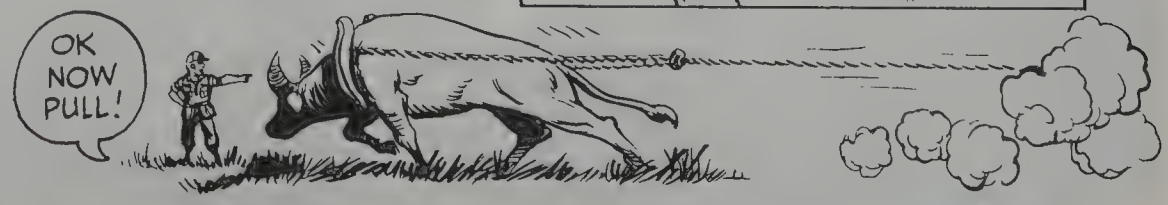
BRAKE — Jam nuts too tight; spring broken, **missing.**

BOLTS — Frame or bumper bolts loose, cracked, **missing.**

POWER TAKEOFF SHIFT LEVER — Stuck, loose; boot gone; **lock not working;** bent.

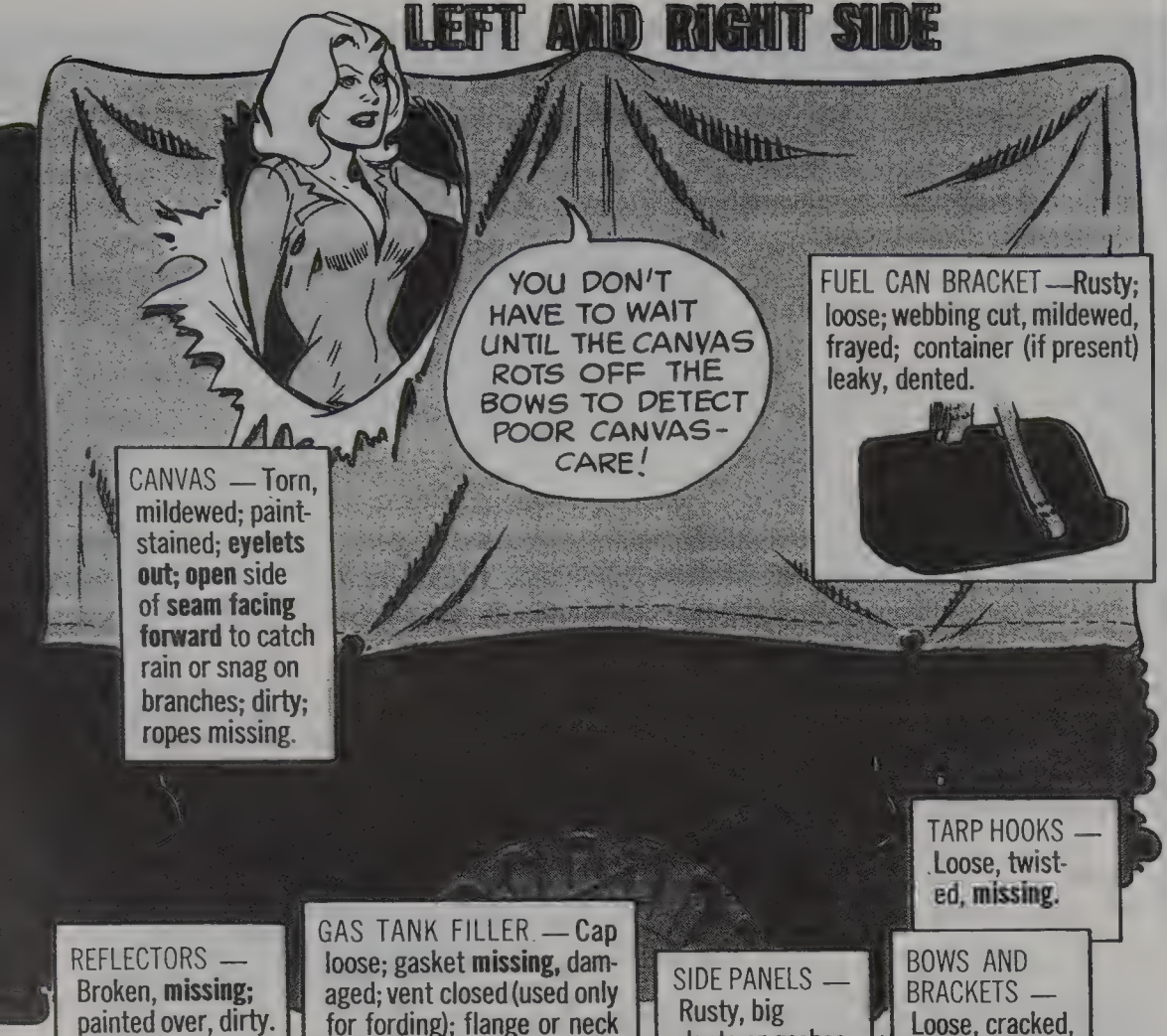


You can get your favorite organizational mechanic to hold the hook while you try the winch out . . . see if it winds OK, stops good, and shapes up. But no use winding too much cable offa that drum and fouling sand into that lube—why carry dirt around?



PS MORE

LEFT AND RIGHT SIDE



CANVAS — Torn, mildewed; paint-stained; **eyelets out; open** side of **seam facing forward** to catch rain or snag on branches; dirty; ropes missing.

FUEL CAN BRACKET — **Rusty;** loose; webbing cut, mildewed, frayed; container (if present) leaky, dented.

TARP HOOKS — Loose, twisted, **missing.**

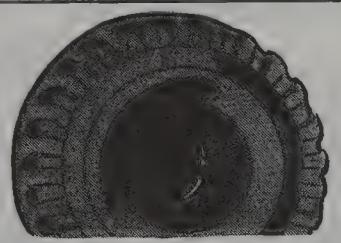
REFLECTORS — Broken, **missing;** painted over, dirty.

GAS TANK FILLER — Cap loose; gasket **missing,** damaged; vent closed (used only for fording); flange or neck bent; strainer, **missing** or dirty; chain **missing;** fuel fill stencils missing.

SIDE PANELS — Rusty, big dents or gashes.

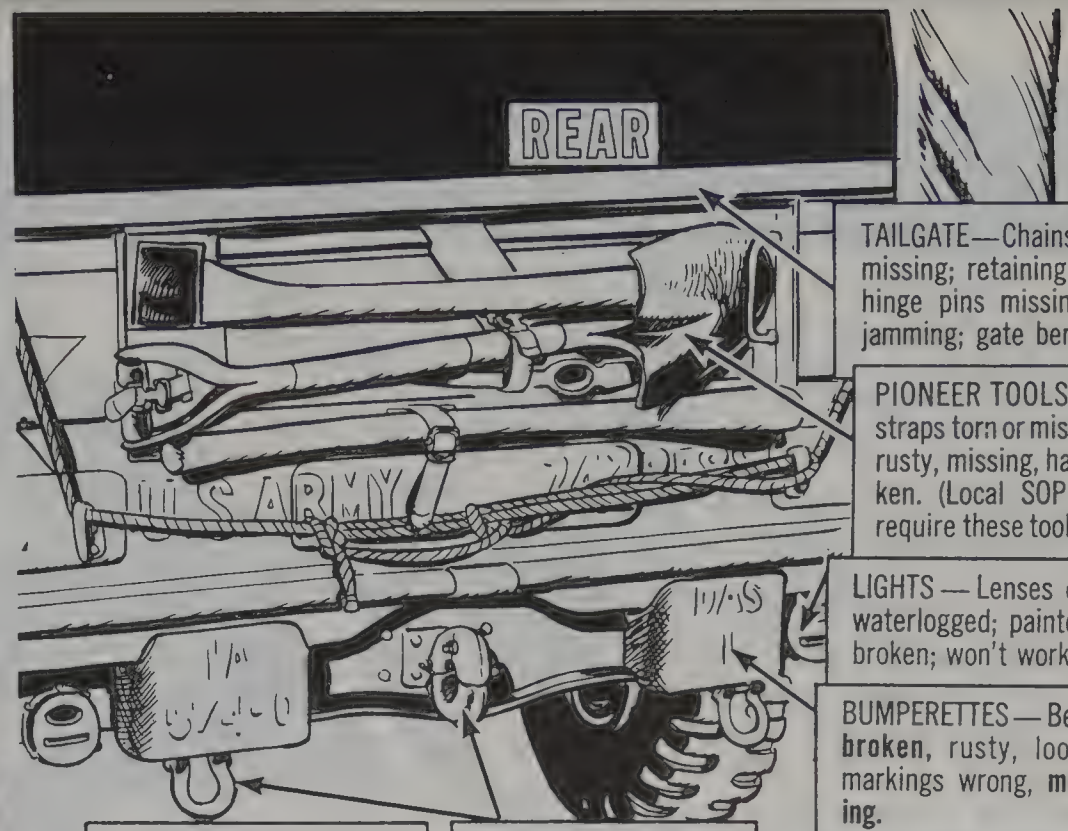
BOWS AND BRACKETS — Loose, cracked, **broken.**

WHEELS & TIRES — Lug nuts or flange bolts loose, **missing;** tread pattern mismatched, tire pressure wrong (40 lb is right); tires **badly** or unevenly **worn, cut** to fabric; rear wheel puller screws bent, jammed; fluid stain on rear hub; valve stems bent, valve caps missing; wheel bent.



SPARE & RACK — Bracket, locking stud, or nut bent, rusty; carrier bent, rusty; tire flat or pressure wrong (Some models carry spare on left door).

REAR



TAILGATE — Chains broken, missing; retaining hook or hinge pins missing, bent, jamming; gate bent, rusty.

PIONEER TOOLS — Loose, straps torn or missing; tools rusty, missing, handles broken. (Local SOP may not require these tools on post).

LIGHTS — Lenses cracked, waterlogged; painted over; broken; won't work.

BUMPERETTES — Bent, **broken,** rusty, loose; markings wrong, **missing.**

COUPLING RECEPTACLE — Cover bent, muddy; contacts loose, burned; spring broken, rusty.

PINTLE & SHACKLES — **Jammed;** unlubed; **won't hold.**

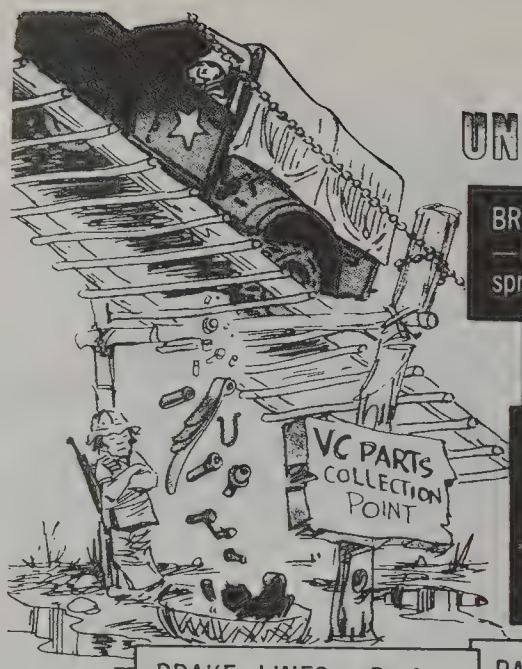
SEATS — **Broken,** rotting, unpainted; brackets bent; pins missing.

SIDE RACKS — Rotting; **missing;** loose; slats, hooks or bolts broken, missing.

FLOOR PLATES — Bent, mud-caked, rusting.

P/S MORE

UNDERNEATH



BRAKE & CLUTCH LINKAGE — Loose, binding, **cracked;** springs missing; unlubed.

FUEL TANK — Supports loose, damaged; **leaking.**

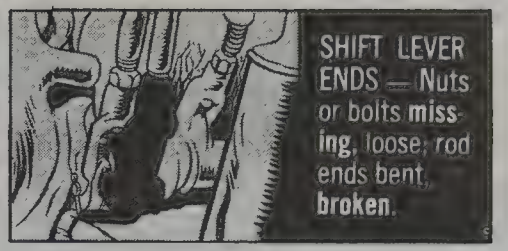
TIE RODS — Clamp **bolts, nuts,** or washers **missing,** loose, unlubed; lube fitting missing, ball stud loose in flange; turn stop missing, broken; ends loose, bent.

SPRINGS — Main Leaf **broken;** pins or U-bolts cracked, **missing,** loose.

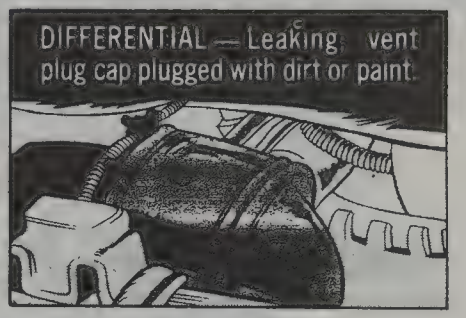
ENGINE MOUNTS — Cracked, **broken; bolts,** nuts, or washers loose, **missing.**

DRIVE SHAFTS — Bent, U-joints unlubed, loose, bolts missing.

CLUTCH HOUSING — Pan gasket leaky, plate seal or plug gasket leaky; drain plug loose, **missing.**



SHIFT LEVER ENDS — Nuts or bolts **missing,** loose; rod ends bent, **broken.**



DIFFERENTIAL — Leaking; vent plug cap plugged with dirt or paint.

BRAKE LINES — **Broken, leaking,** pinched; spring clips loose, missing.

BACK PLATE ATTACHMENTS — Fittings loose, missing, **leaking;** anchor bolts loose, **missing.**

CRANKCASE PAN — **Leaking 5 drops or more per minute.**

STEERING KNUCKLES and BALL JOINTS — **Worn,** rusty, **unlubed,** loose, dented, leaking; bolts **missing,** loose.

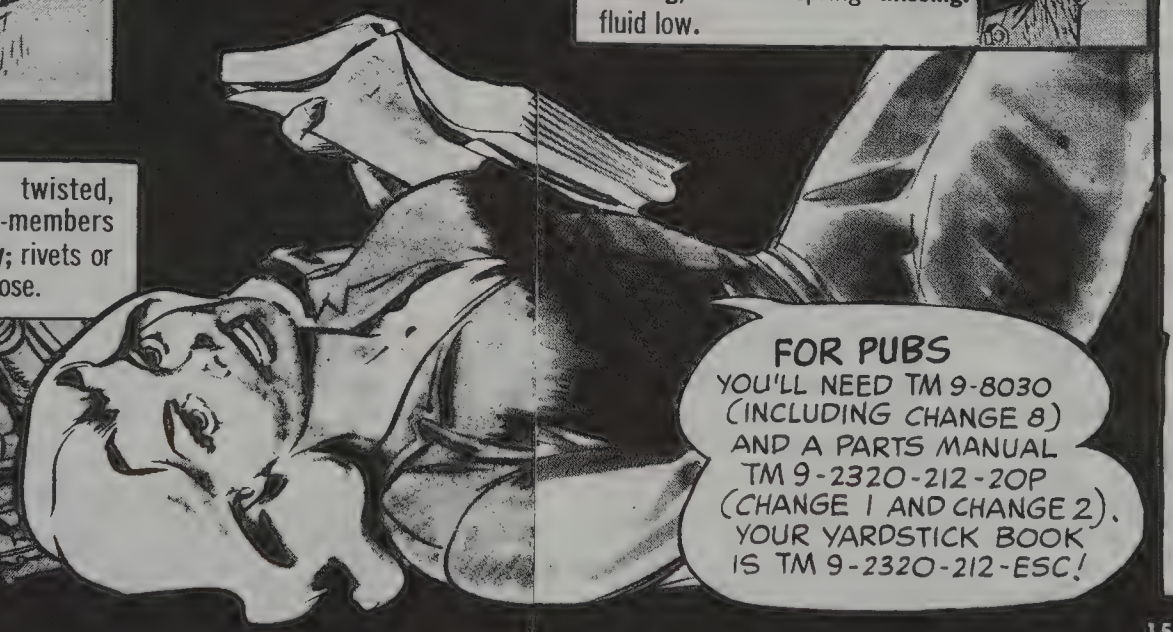
TRANSMISSION CASE — **Leaking 5 drops or more per minute;** loose in mount; bolts **broken, missing.**

BRAKE MASTER CYLINDER — Push rod bent or safety nut loose; lines loose; fluid **leaking;** cotter pin gone on pedal rod end; **boot** torn or **missing;** return spring **missing.** fluid low.

SHOCK ABSORBERS — Cylinders stuck, dented; **bolts, nuts missing;** clip plate bent, **broken;** rubber shock bumpers (over axles) missing, cracked.

EXHAUST PIPE, MUFFLER, TAILPIPE — **Holes,** soft spots, flange connections loose.

FRAME — Bent, twisted, **cracked;** cross-members loose, **bent badly;** rivets or bolts missing, loose.


FOR PUBS
YOU'LL NEED TM 9-8030 (INCLUDING CHANGE 8) AND A PARTS MANUAL TM 9-2320-212-20P (CHANGE 1 AND CHANGE 2). YOUR YARDSTICK BOOK IS TM 9-2320-212-ESC!

WEATHER WISDOM

Depending on local SOP, a change o' season brings more to check. Your checkup switches a bit —so like in winter, look after—

CHAINS — Links or cross-chains broken; wrong sizes for wheels; too few chains to go around.

ANTIFREEZE — Installed before frostfall (TM 9-207 tells all); have your favorite mech check.

BATTERIES — Winter specific gravity standard is 1.280. Have your shop make sure.

Then come spring, you drain that anti-freeze and the rust and guck suspended in it (TB Ord 651), make with warm-weather LO specs . . . and you're in.

PS END

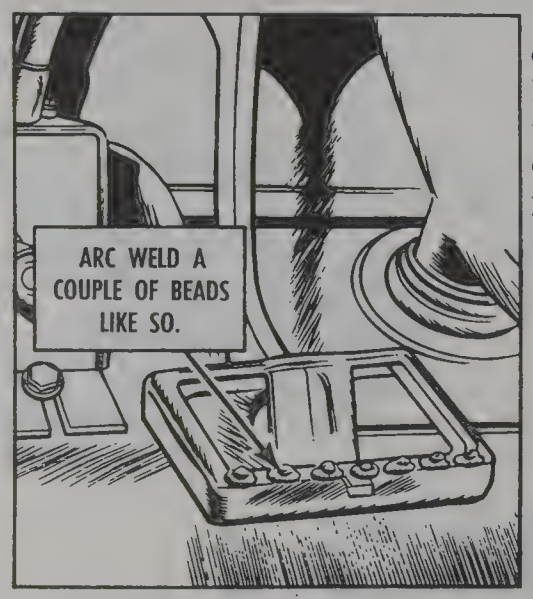
GROUND MOBILITY

BEADS O' SAFETY . . .

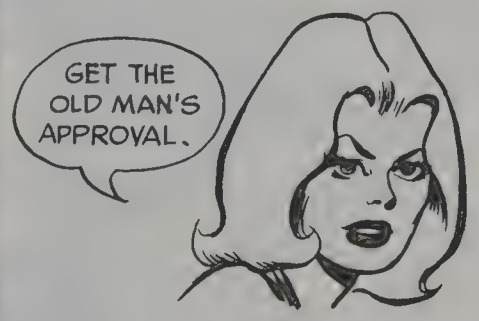
SLIP-PROOF PEDALS

A banana peel on a slick floor is no slipperier than the brake and clutch pedals on some vehicles — especially when the pedal surface is all metal, when the metal's worn down smooth and when you've got mud or snow on your boots.

When you're operatin' a vehicle like a G838-series 1/4-ton or G741-series 3/4-ton truck, take care to clean the mud or snow off your boots before hoppin' in. And keep this stuff cleaned off the pedals, too.



If your CO gives the OK, you can get extra insurance against slippery pedals by having little bumps arc welded onto the pedal. Just across the leading edge of the pedal may be enough. This'll give your boots something to grab ahold of.



AR 385-55 (Sep 65), para 25, allows commanders to authorize "additional devices" for prevention of motor vehicle accidents — and you can sure have a dilly if your foot slips off the brake or clutch pedal at the wrong time.

KIT THAT SHAFT

OH! PACK UP YR' TROUBLES IN YR' OL' KIT PARTS, U-JOINT FRONT 'N REAR AXLE PROP SHAFT, FSN 2520-656-3629, GASP! N' SMILE, SMILE, SMILE
HMM... WONDER IF HE'S TRYIN' TO TELL US SOMETHING.

Since you can kit repair your G741-series ¾-ton truck prop shafts, no point in asking for a whole shaft assembly when you need repair work. Parts kit, U-joint, front and rear axle prop shaft, FSN 2520-656-3629, may be all you need. Don't ask for the one listed on page 49 of TM 9-2320-212-20P (Feb 60) because it has the superseded FSN 2520-495-2266. Another point . . . the kit only costs $5.26 whereas the shaft assembly runs as much as $30.84 . . . besides being in short supply.

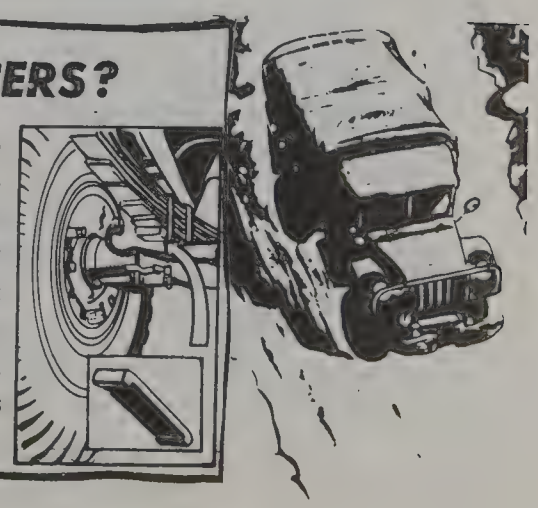
G741-SERIES ¾-TON TRUCK . . .

BEEP-BEEP-BEEP

That's the signal to right that wrong FSN for Retainer, electrical contact: horn button cable contact. It's in Ch 1 (Nov 62) to TM 9-2320-212-20P under FSN 2920-626-0236, but it should be FSN 2590-626-0236. The right FSN shows up in Fed Cat C2590-IL-A (Apr 68) and will be picked up in the next -20P change or revision.

WHY SPRING SPACERS?

Ever wonder why there're spacers under the left front and rear springs of the ¾-ton M37, M37B1, M43 and M43B1 trucks but none on the right side? They compensate for the slight list in the vehicle body with the added weight of the spare tire on the left side. For either front or rear, the spacer is listed as FSN 2510-737-6829 (G741).



A DANGLER

Dear Half-Mast,

We have a batch of ¾-ton G741-series trucks and every one has a strap dangling from each side of the cargo body about two feet to the rear of the cab.

We don't know how to use 'em. An old timer said they're to tie prisoners to by their wrist so they can run alongside when the cargo body is full.

I'm sure he's pulling my leg, but what are they for?

Pvt O. T. L.

Dear Private O. T. L.,

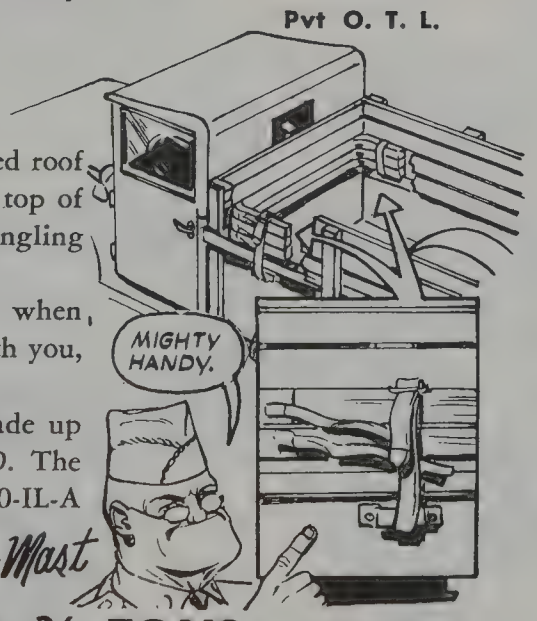
That old timer was just spoofing you.

The straps are for securing your dismantled roof bow assembly. The bows lie full length on top of the cargo rail and are tied down with the dangling straps.

Keep the straps in good shape because when you've got to take your dismantled bows with you, the straps come in mighty handy.

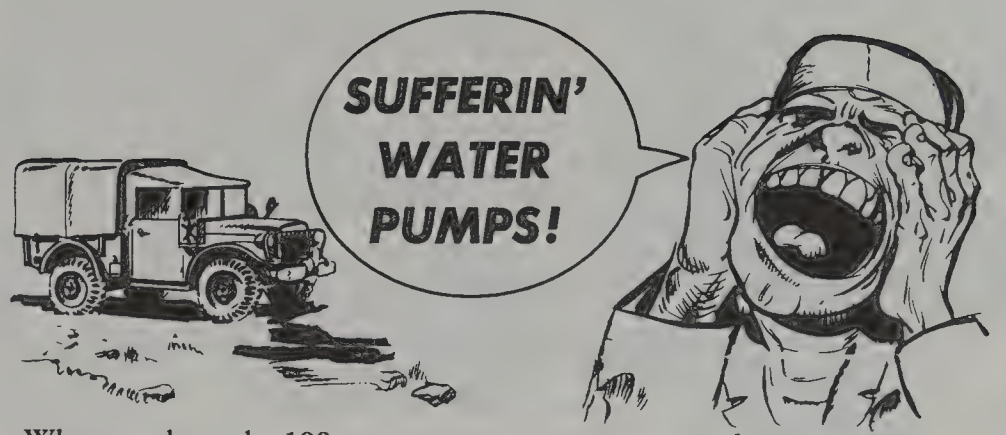
When you need new straps, have 'em made up from Bulk Web Strap, FSN 8305-263-2479. The bulk strap is in Federal Supply Catalog C8300-IL-A (May 69).

Half-Mast



100 AMPS FOR ¾-TONS

If a lot of commo equipment on your M37 or M37B1 3/4-ton truck really loads down the electrical system, then you need more than those little 45-amp batteries. TB 9-2320-212-20/2 (Oct 62) authorizes 100-amp batteries and gives with fabricated carriers to handle those bigger batteries.



When you have the 100-amp generator system mounted on your ¾-ton M37-series truck, the fan belt tension adjustment should be no guessing game.

Too many ruined water pumps tell of bad guesses. Too tight is usually the trouble maker.

Like it says in Change 3 (Jan 68) to TM 9–8031–2.

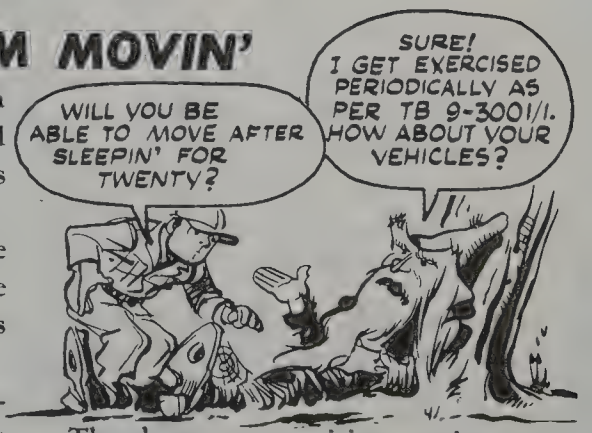
1. Pull outward and tighten adjusting arm at a point where some play remains in belt.
2. Check adjustment – place a straight edge over pump and generator pulleys
3. Readjust belt until you get a ½ inch deflection when you put a firm push on the center of the belt.
4. Tighten arm to engine block screw to 35–40 lb–ft.
5. Tighten arm to generator bolt to 60–70 lb–ft.
6. Make sure generator does not interfere with oil pressure sending unit.

KEEP 'EM MOVIN'

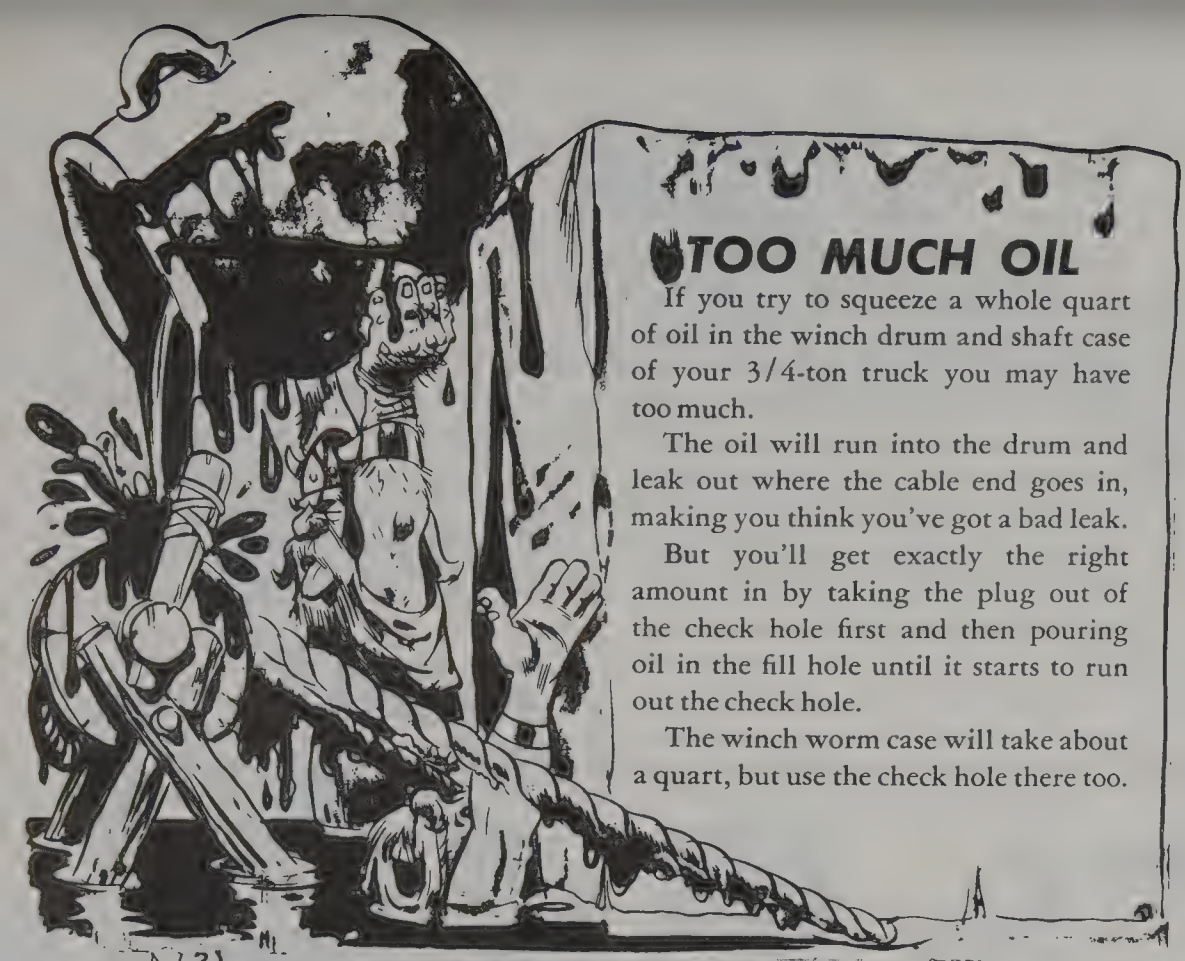
Rip Van Winkle hardly twitched a muscle for 20 years but could still get around when he woke up. **That's fiction.**

Let your tracked or wheeled vehicle sit still for long and it's apt to freeze up and just generally go to pot. **That's fact.**

Maybe your equipment's out of action just because it's missing some part or is waiting for minor repairs. If it's deadlined for 90 days or more — either up on blocks or on its wheels or tracks — it's supposed to get exercise to keep parts from rusting or seizing.


WILL YOU BE ABLE TO MOVE AFTER SLEEPIN' FOR TWENTY?
SURE! I GET EXERCISED PERIODICALLY AS PER TB 9-3001/1. HOW ABOUT YOUR VEHICLES?

The dope on exercising equipment in storage for 90 days or more is in TB 9-300-1/1 with Change 2 (for combat vehicles) and TB 9-300-2/1 with Change 3 (for tactical wheeled vehicles).



TOO MUCH OIL

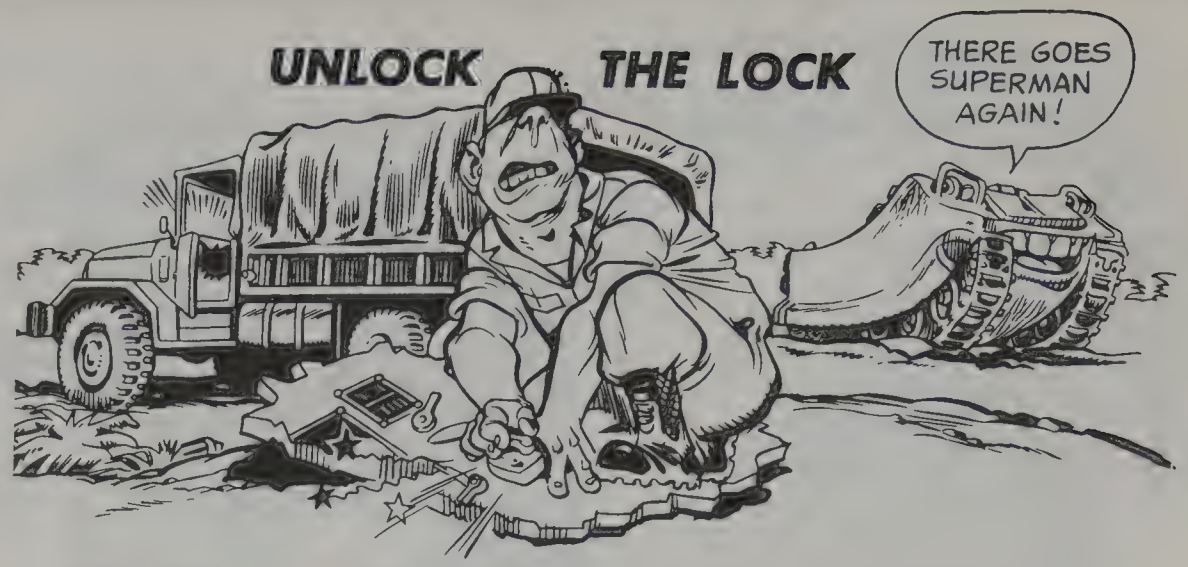
If you try to squeeze a whole quart of oil in the winch drum and shaft case of your 3/4-ton truck you may have too much.

The oil will run into the drum and leak out where the cable end goes in, making you think you've got a bad leak.

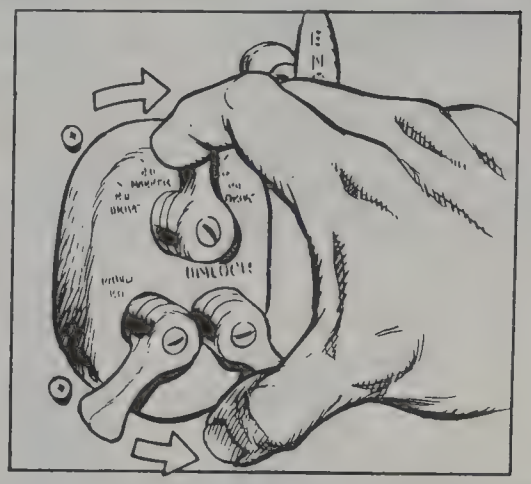
But you'll get exactly the right amount in by taking the plug out of the check hole first and then pouring oil in the fill hole until it starts to run out the check hole.

The winch worm case will take about a quart, but use the check hole there too.

UNLOCK THE LOCK



The light switch unlock lever on your M-series track or wheel vehicle serves a good purpose.

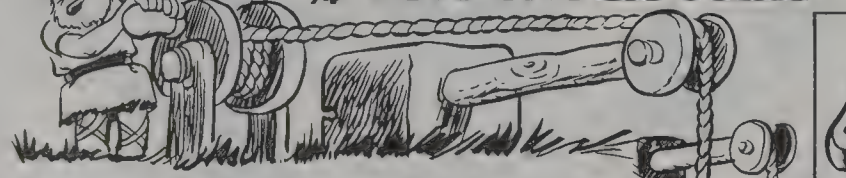


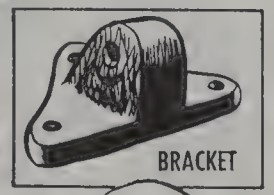
The spring-loaded unlock lever prevents accidental movement of the selector lever to any position except to BO MARKER and OFF.

To move the main switch seleetor lever to any ON position, except BO MARKER, the unlock lever must be lifted to the unlock position—or else! Using muscle on the selector lever without first using the unlock lever will bust the switch for real and sideline your vehicle.

So, to keep busted switches from piling up in the repair shop be sure you hold the unlock lever "up"—then move your selector switch.

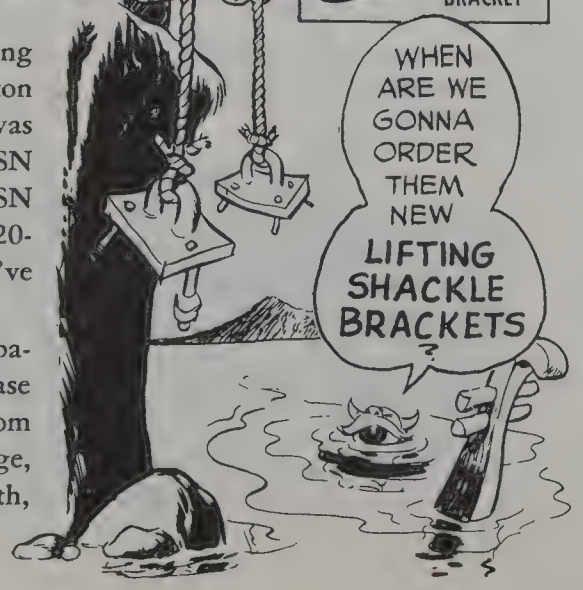
3/4-TON TRUCK PART





New, better brackets for front lifting shackles on your G741-series 3/4-ton truck—you need 'em if your truck was made in 1962 or before. Bracket, FSN 2510-973-4188, replaces Bracket, FSN 2510-770-5779, that's in TM 9-2320-212-20P (Feb 60). Make sure you've got the heavier new job.

Here's some differences (old in parentheses): cast steel (cast iron); base thickness, 1/2 inch (3/8 inch); from center of mounting hole to outer edge, 5/8 inch (1/2 inch); overall width, 5-1/4 inches (5 inches).

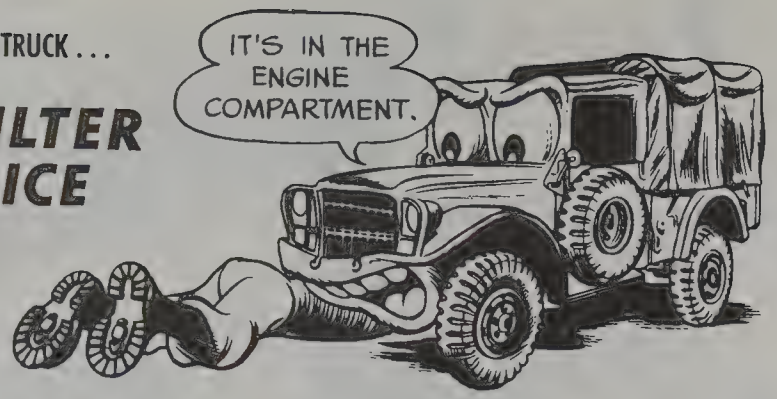


HAND-BRAKE SCREW

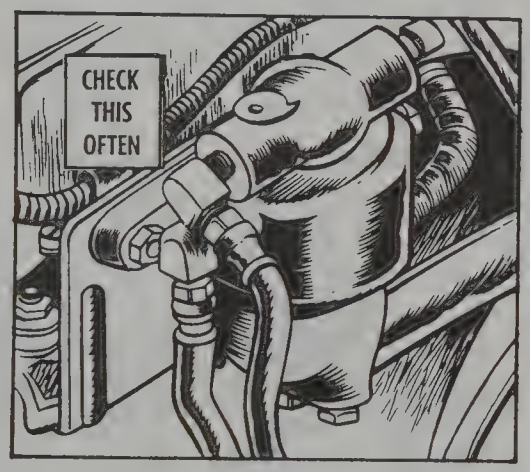
Need the Bolt, Machine, adjusting, brake-band bracket for your 3/4-ton that's listed under FSN 5305-732-4143 on page 56 of TM 9-2320-212-20P (Feb 60)? Then ask for it by using FSN 5305-622-9484. The FSN listed in the 20P brings the long hook bolt that's shown in Fig 49—not the adjusting screw. FSN 5305-622-9484 is a good number and is listed in Fed Cat C5305-IL-A (Jul 66).

G741-SERIES ¾-TON TRUCK . . .

NEW FILTER SERVICE



You've got a new semiannual service on your M37B1 3/4-ton truck — or other G741-series vehicle. You do if you've got the fuel filter in the engine compartment.



Ch 9 (Jun 68) to TM 9-8030 tells you to replace that fuel filter element every 6,000 miles or every 6 months, whichever rolls around first. This new info goes in the how-to-do-it section of the TM (para 139), not in Table III where you find your other semiannual PM services. Fact is, those other semiannual services are pulled at 3,000 miles or 6 months, a shorter mileage factor than you've got for the fuel filter element.

But Table III still calls for cleaning the sediment bowl of the fuel filter every 3,000 miles or 6 months.

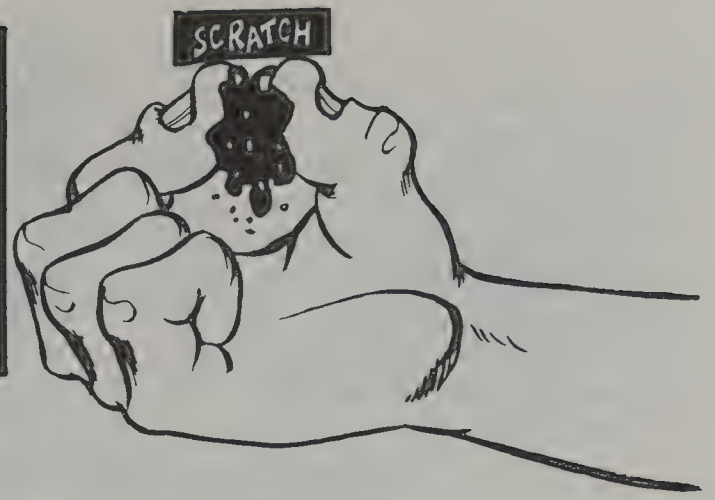
A new filter element comes under FSN 2910-455-4033, page 21, TM 9-2320-212-20P w/Ch 1 and Ch 2 (Jul 64).

There's no reg'lar replacement of the element for the in-tank type fuel filter found in later production vehicles (after Serial No. 80042292). This filter gets service only if it happens to be out for fuel tank servicing or if you suspect the filter's giving you trouble. Then para 139c in TM 9-8030 tells you how to clean it.

If you need a new element for the in-tank fuel filter, it comes under FSN 2910-735-1316, page 24 in the -20P TM. This FSN has been exhausted to 2910-955-2010.

OIL BATH AIR CLEANERS

HOW DIRTY IS DIRTY?



Dear Half-Mast,

We have oil bath air cleaners on some of our vehicles and also on some of our generators and earth-moving and load-lifting engineer equipment.

Oil in the air cleaner reservoir sometimes needs changing in between the intervals called for by the LO.

Two questions:

How dirty is dirty when deciding whether the oil needs changing?

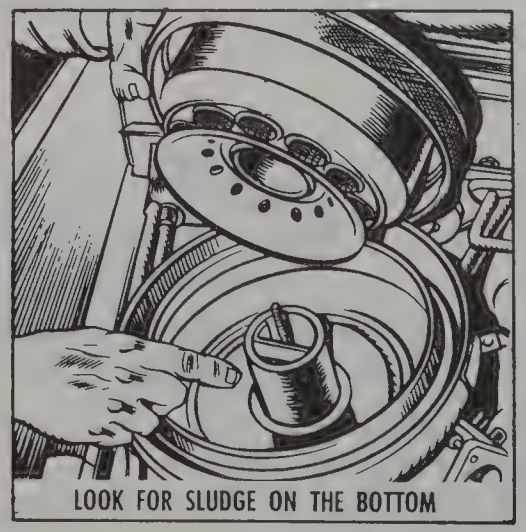
Is used engine oil suitable for use in the reservoir (as some LO's specify)?

COL S. A. R.

Dear Colonel S. A. R.,

There was a time when 1/4 inch of sludge in the bottom of the reservoir was the most allowable.

Now, though, any sludge or grit sitting on the bottom of the reservoir is too much. If a finger, rubbed across the bottom, brings up sludge; it's time to change oil. Rubbing some oil between the fingers may show there's dirt "suspended," or floating, in the oil, but this by itself is not enough reason to change the oil.


LOOK FOR SLUDGE ON THE BOTTOM

Dirt settles to the bottom of the reservoir when the oil becomes so loaded with light, airborne dirt that it can't hold any more. Then the oil doesn't do the job it's supposed to. Dirt carried on into the engine cuts its efficiency — and life.

Saving on oil at the expense of an engine — or a mission — is a losing game.

For the same reason, used engine oil in the air cleaner reservoir is out. Older LO's that call for used engine oil will be changed to specify new engine oil.

Half-Mast

MISSING LINK?

Dear Half-Mast,

Our ¾-ton G741-series trucks have been living with this problem for some time.

It's the Tinnerman-type lock washer (FSN 5310-752-6591) that's listed on page 34 of TM 9-2320-212-20P that's giving us trouble.

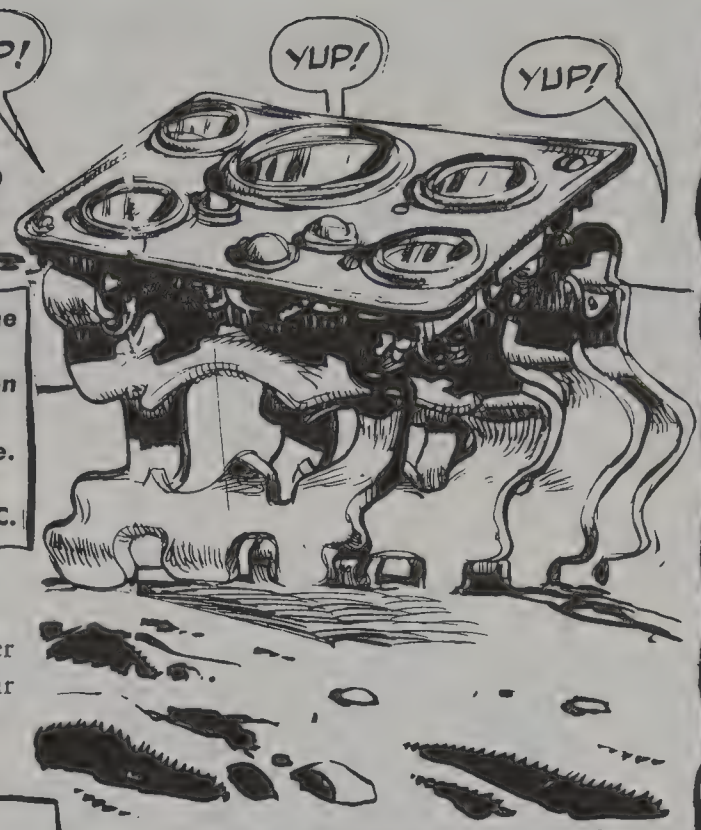
This washer seems to be too small to hold the cluster plate panel in place. How do we make it work?

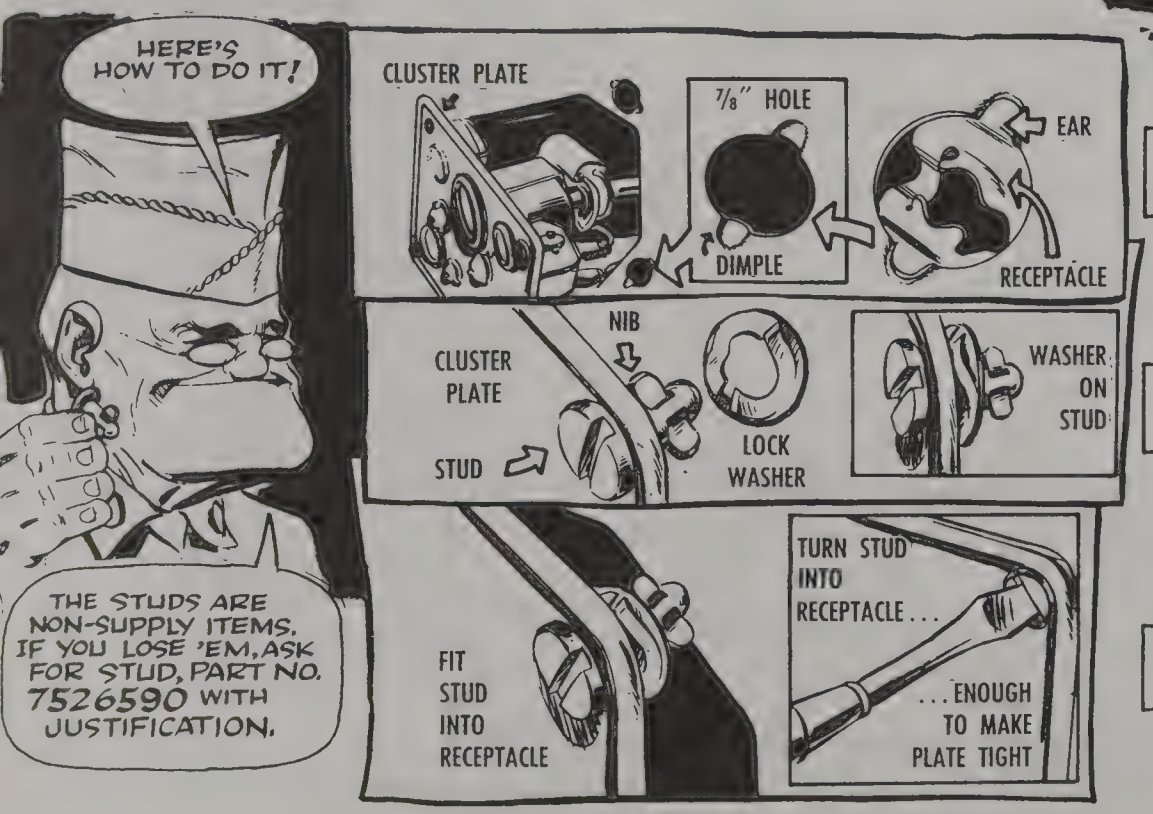
WO K. H. C.

Dear Mr. K. H. C.,

You need another part.

The missing link is the four receptacles listed on page 35 in your -20P under FSN 2510-753-9255 (now changed to FSN 5325-753-9255). Without 'em, your lock washer will slip right thru those dashboard holes.





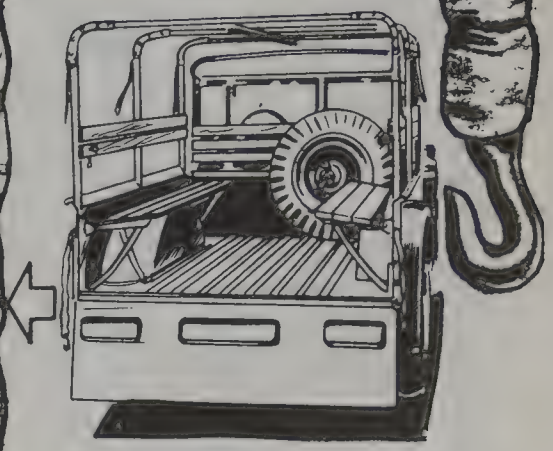
From inside the dash you slip the two ears on the receptacle thru the four ⅞-in holes cut into the dash to take the cluster plate. The ears go into the small recess (dimple) on the outside of the holes, and retain the receptacle.

Then, put the studs thru the corner holes in the cluster plate and squeeze the Tinnerman-type washer over the nibs on the stud.

Fit the plate, studs and washers into the dash and turn the stud slightly into the receptacles—just enough to tighten the plate good 'n' snug.

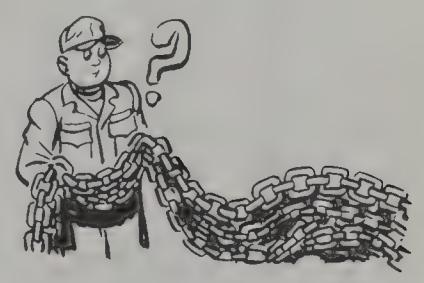
Half-Mast

HOOK ROOK



Careful about getting hooked when you want a tail-gate hook for your ¾-ton truck.

If you order Hook, FSN 4030-274-3472 that's on page 72 of TM 9-2320-212-20P (Feb 60); you'll get a log-chain hook.



What you need is in Change 1 (Nov 62) to TM 9-2320-212-20P — it has the last item listed. It's Chain, Retaining, Tailgate Assy, FSN 2540-700-5440, and it has the right hook.

LUBRICATION ORDER

LC 19-75AA-9

LO 9-8030

2 December 1953 (Supersedes LO 9-840, 29 May 1951)

TRUCK, ¾-TON, 4 x 4, M37, M42, M43, V-41( )/GT

References: TM 9-840; ORD 7 SNL G-741

Clean fittings before lubricating. Clean parts with THINNER, paint, volatile mineral spirits (TPM) or SOLVENT, dry cleaning (SD). Dry before lubricating. Lubricate dotted arrow points on both sides of the equipment.

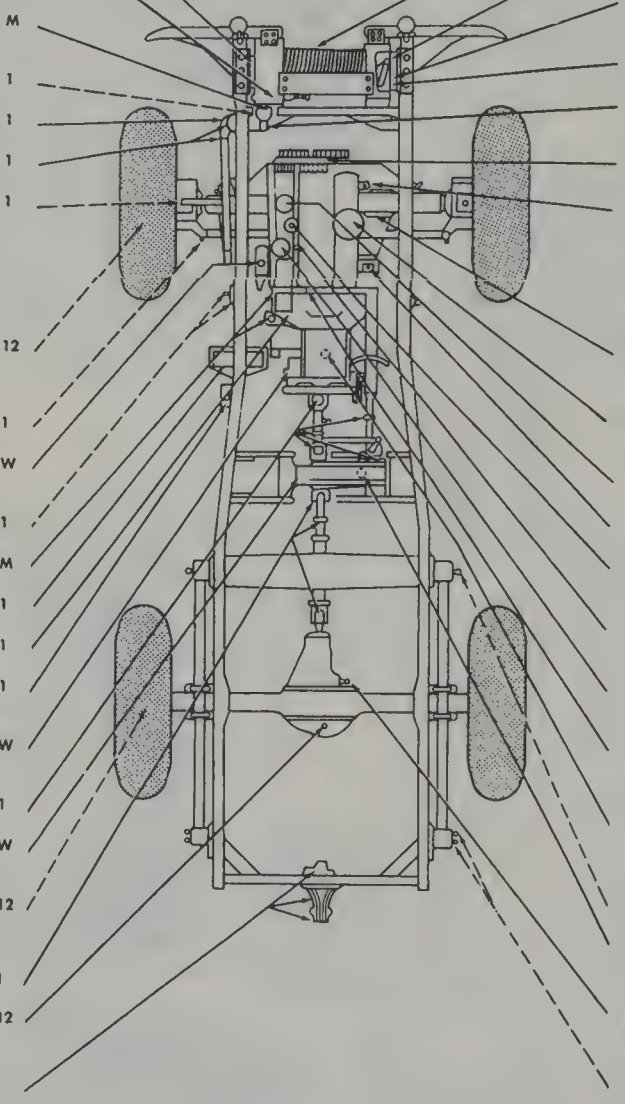
Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions or contaminated lubricants. During inactive periods, intervals may be extended commensurate with adequate preservation. Relubricate after washing or fording.

LUBRICANT • INTERVAL

C, Fig 35	Winch Worm Case Level (Check level)		W
D, Fig 35	Winch Worm Case Drain (Drain and refill) (Cap. 1 qt.)		A
A, Fig 35	Winch Worm Case Fill	GO	
G, Fig 35	Winch Universal Joint and Propeller Shaft Yoke	GAA	M
L, Fig 35	Spring Bolt	GAA	1
H, Fig 35	Steering Idler Arm	GAA	1
J, Fig 35	Steering Drag Links	GAA	1
M, Fig 36	Universal Joint and Steering Knuckle Bearings (See note 6)	GAA	1
W, Fig 36	Front Wheel Bearings (Every 12,000 miles or annually, remove, clean, dry and repack)	GAA	12
N, Fig 36	Tie Rod	GAA	1
K, Fig 35	Steering Gear Fill and Level (Check level)	GO	W
Y, Fig 37	Spring Shackle	GAA	1
F, Fig 35	Winch Universal and Slip Joint	GAA	M
Z, Fig 37	Clutch and Brake Pedal Shaft	GAA	1
Q, Fig 36	Clutch Release Fork Bushing	PL	1
X, Fig 36	Brake Master Cylinder (Fill to ½ in. from top)	HB	1
R, Fig 36	Transmission Fill and Level (Check level) (See note 5)	GO	W
T, Fig 36	Universal and Slip Joints	GAA	1
AA, Fig 37	Transfer Case Fill and Level (Check level)	GO	W
BB, Fig 37	Rear Wheel Bearings (Every 12,000 miles or annually, remove, clean, dry and repack)	GAA	12
U, V, Fig 36	Universal and Slip Joints	GAA	1
FF, Fig 38	Rear Differential Drain (Drain and refill) (Cap. 2½ qts.) (See note 5)		12
HH, Fig 38	Pintle Hook	GAA	1

INTERVAL • LUBRICANT

	OE	Winch Cable (See note 7)	B, Fig 35
W		Winch Drum and Shaft Case Level (Check level)	C, Fig 35
A		Winch Drum and Shaft Case Drain (Drain and refill) (Cap. 1 qt.)	D, Fig 35
W	GO	Winch Drum and Shaft Case Fill	A, Fig 35
	GAA	Winch Propeller Shaft Shear Pin (See note 8)	G, Fig 35
1	WP	Water Pump	QQ, Fig 39
12		Front Differential Drain (Drain and refill) (Cap. 2½ qts.) (See note 5)	E, Fig 35
W	GO	Front Differential Fill and Level (Check level)	EE, Fig 38
D	OE	Air Cleaner (Check level) (See note 1)	PP, Fig 39
	OE	Crankcase Fill	LL, Fig 38
1	GAA	Universal Joint	V, Fig 36
S		Distributor (See note 4)	JJ, KK, Fig 38
D		Crankcase Level (Check level)	NN, Fig 38
1		Oil Filter (See note 3)	MM, Fig 38
6		Crankcase Drain (Drain and refill) (Cap. 5 qts.) (See note 2)	P, Fig 36
12		Transmission Drain (Drain and refill) (Cap. 6 pts. w/o PTO, 7 pts. w/PTO.) (See note 5)	S, Fig 36
1	GAA	Spring Bolt	GG, Fig 38
12		Transfer Case Drain (Drain and refill) (Cap. 5 pts.) (See note 5)	CC, Fig 37
W	GO	Rear Differential Fill and Level (Check level)	EE, Fig 38
1	GAA	Spring Shackle	DD, Fig 38



RA PD 196267

M37 LUBRICATION ORDER

Figure numbers and identifier letters refer to pages 64 to 69 of Technical Manual TM 9-8030. Lubricants are more fully described in the Key on the following page. In the 1970's, the military approved the use of multi-viscosity oil (10W-30) to replace the single viscosity oils called for in the lubrication order.

KEY

LUBRICANTS	EXPECTED TEMPERATURES			For Arctic Operation Refer to TM 9-2855	LUBRICANTS	INTERVALS
	above +32° F	+40° F to −10 F°	0° F to −65° F			
OE-Oil, lubr, engine	OE 30	OE 10	OES		**OES-Oil**, lubr, engine, sub-zero	D—Daily W—Weekly M—Monthly S—Semi-annually A—Annually 1—1,000 Miles 6—6,000 Miles 12—12,000 Miles
GO-Lubricant, Gear, universal	GO 90	GO 75	GOS		**GOS-Lubricant**, gear, universal, sub-zero	
GAA-Grease, lubr, automotive and artillery	GAA	GAA	GAA		**HBA-Fluid**, hydraulic, brake, arctic	
HB-Fluid, hydraulic, brake	HB	HB	HBA		**CW-Lubricant**, chain, exposed gear and wire rope	
PL-Oil, lubr, preservative	PL (Med)	PL (Special)	PL (Special)		**WP-Grease**, lubr, water pump	

NOTES

1. AIR CLEANER—(Oil bath type). Daily, replenish to bead level with OE, crankcase grade. Every 1,000 miles, clean oil reservoir and refill with OE as above. Disassemble, clean all parts, refill with OE as above whenever crankcase oil is changed. For desert or extremely dusty operation, disassemble, clean all parts and refill with OE once every operating day or more frequently if required.
2. CRANKCASE—Drain every 6,000 miles or semiannually. Drain only when hot after operation. Refill to FULL mark on gage. Run engine a few minutes and recheck oil level. For proper operation on heavy duty engine oil, engine thermostat must be functioning properly to maintain engine coolant temperature at 140° F. minimum.
3. OIL FILTER—Every 1,000 miles remove plug in bottom of case and drain sediment. Every 6,000 miles or semiannually, when crankcase is being drained, remove element, clean inside of case and install new element.
4. DISTRIBUTOR—Every 6,000 miles or semiannually, remove distributor, remove plug under name plate and withdraw felt wick. Soak wick in PL. Fill plug opening with GAA. Insert wick, remove excess grease and install plug. Wipe breaker cam lightly with GAA and breaker arm pivot with 1 to 2 drops of PL.
5. GEAR CASES—Drain every 12,000 miles or annually. Drain only when hot after operation. Fill to plug levels (except transmission) before operation and after draining. Clean vents weekly and after operation in mud or water. TRANSMISSION LEVEL: Check level weekly. To check level remove cap screw located upper rear side of right hand power-take-off cover. Remove fill plug and fill to level of screw hole. When replacing cap screw discard lock washer and replace with copper or brass flat washer. (W o PTO without power-take-off; W PTO with power-take-off.)
6. FRONT WHEEL UNIVERSAL JOINTS AND STEERING KNUCKLE BEARINGS—Every 1,000 miles or semiannually, remove lower plug and lubricate through fitting located on top of steering knuckle flange until lubricant appears at lower plug hole. Replace plug. Do not disassemble constant velocity universal joints.
7. WINCH CABLE—After each operation, clean and oil with used crankcase oil or OE. Weekly, if cable has not been used, coat outer coils. Monthly, unwind entire cable, clean and oil. Semiannually, if cable is not generally used, unwind entire cable, clean and soak, by means of a brush, with PL (Special) wipe off excess and coat cable with CW. Coat winch drum also with CW before rewinding cable or drum.
8. WINCH PROPELLER SHAFT SHEAR PIN—Semiannually, disconnect front universal joint, remove shear pin and universal joint from shaft, clean, dry and coat end of shaft and inside of universal joint collar with GAA to prevent rusting.
9. OIL CAN POINTS—Every 1,000 miles or monthly, lubricate hinges and latches, clutch and brake pedal linkage, parking brake linkage, transfer controls, winch shifter shaft with PL.
10. DO NOT LUBRICATE—Shock absorbers, springs, clutch release bearing.
11. LUBRICATE AT TIME OF DISASSEMBLY BY ORDNANCE PERSONNEL—Generator, starter, clutch pilot bearing, speedometer flexible shaft.

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

OFFICIAL:

WM. E. BERGIN,
Major General, United States Army,
The Adjutant General.

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

OFFICIAL:

K. E. THIEBAUD,
Colonel, United States Air Force,
Air Adjutant General.

N. F. TWINING,
Chief of Staff,
United States Air Force.

RA PD 359235

On the next four pages is an excerpt of a rare Modification Work Order for the M37 originally issued Feb. 23, 1965 and updated in Aug. 1965. Not only is the MWO itself somewhat rare, but it was rarely carried out, even though it was supposed to have been applied to every M37 and M37B1 in service in 1965.

MWO 9-2320-212-30 / 5

DEPARTMENT OF THE ARMY MODIFICATION WORK ORDER

TRUCK, CARGO: 3/4 TON, 4x4, M37 AND M37B1: REINFORCING VEHICLE TAIL GATE

Headquarters, Department of the Army, Washington, D.C.
24 August 1965

[The printed material below is an *excerpt* of the 1½-page MWO as many of points, sub-points, stock numbers, and the reporting procedures and forms are not relevant.]

1. **Application.** *a. Authorization.* This modification work order is authorized to prevent serious damage to equipment.

b. Category of Maintenance. Direct support.

c. Applied by. Welder (MOS 442).

d. Time required. 2 man-hours.

e. Material required. Steel, carbon: strip, cold rolled, 1/8" x 1" x 27". Federal Stock No. 9515-267-1188.

2. **Priority Classification.** This modification is classified in the NORMAL group and will be accomplished on all M37 and M37B1, 3/4 ton, 4x4, cargo truck tail gates below vehicle Registration No. 3E6767 Vehicle Serial No. 15762.

3. **Equipment Affected.** *a.* Application of this modification will be made to all issued equipment to active Army using units, maintenance float and station stock. Application will be made consistent with the needs of the service and in all cases within six months of the publication date of this MWO.

b. Application of this modification will be made to all other Army owned assets (except unserviceable, economically unrepairable items) within twelve months of publication date. Items [vehicles] will not be issued prior to application of MWO.

4. **Parts Affected.** *a. Parts to be modified.* Tail gate (welded) including brackets, panel, space, and tube.

b. Parts to be discarded. None.

5. **Drawings Required to Apply Modification.** None.

6. **Special Tools, Jigs, and Fixtures Required.** None.

7. **Modification Procedure.** *a.* Fabricate reinforcement from steel FSN 9515-267-1188 for left and right side of tail gate as indicated in figure 1 (left side shown).

b. Position and hold reinforcement in place with "C" clamps (fig. 1).

c. Weld center of reinforcements in place as indicated in figure 2. Note: the 1" fillet weld shown in fig. 2 was accomplished using a 3/32 mild steel rod with 80 to 90 amperes (dc) current. Arc weld in accordance with TM 9-237.

d. Position "C" clamps on the upper and lower end of tail gate forcing angles of reinforcement into the corners. With a hammer form reinforcement to contours of the tail gate as shown in figure 2.

e. Weld left and right reinforcements to tail gate in places indicated in figure 3.

f. Clean, prime and paint and required in accordance with TM 9-213.

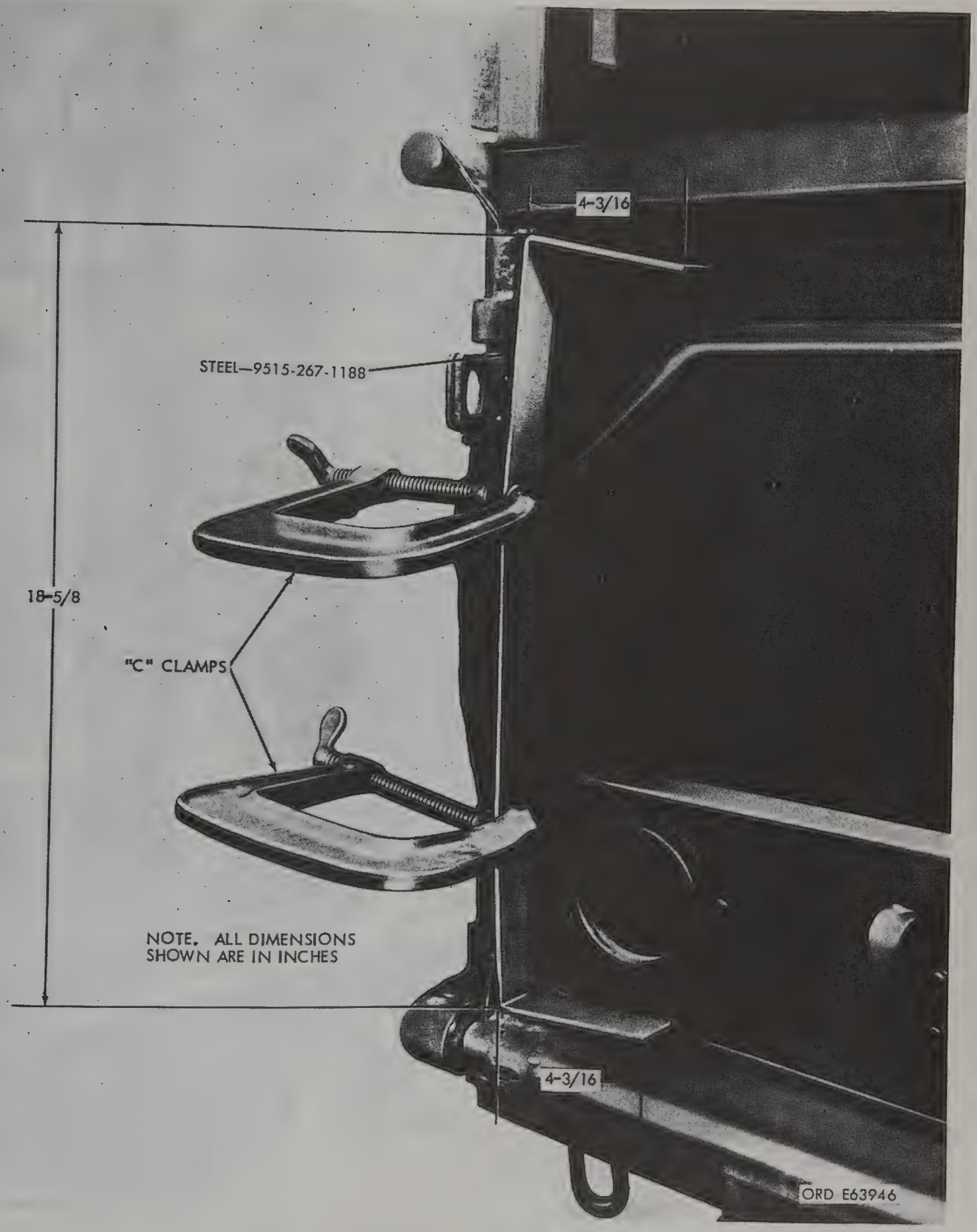


Figure 1. Reinforcement in place before welding.

NOTE. ALL WELDS TO BE
1-INCH FILLET WELDS

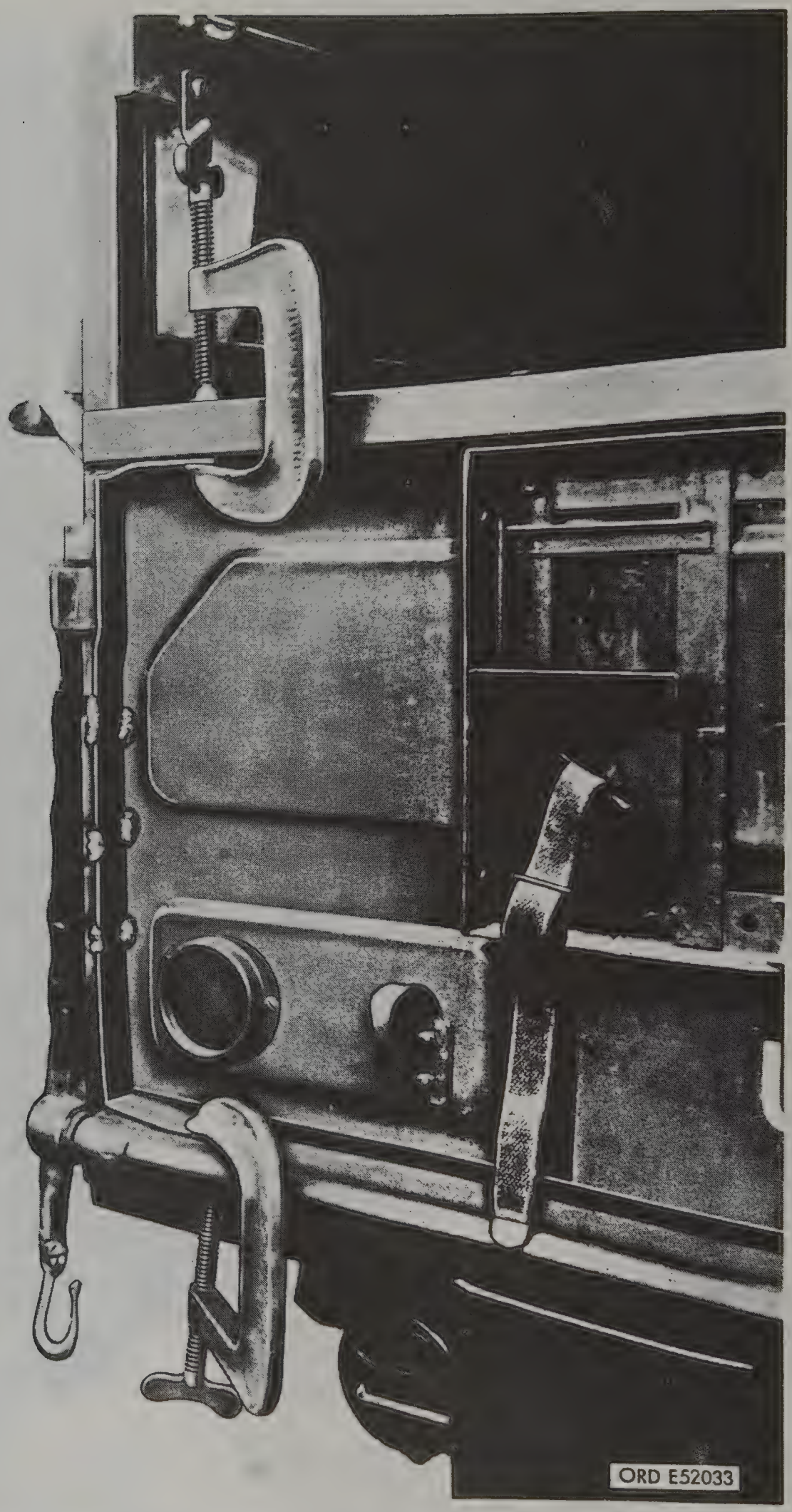


Figure 2. Reinforcement formed to contours of tail gate.

Figure 3. Tail gate reinforcements welded in place.

Finishing What You Start

by Jim Richardson

I am very pleased to welcome to our pages Jim Richardson, who will be writing a series of articles about body restoration. Jim has been a long-time contributor to *Classic Auto Restorer* magazine, appears on the TNN network TV show, *My Classic Car*, and is one of the most knowledgable people on body restoration in the country. —*DHA*

So you're the grizzled veteran of the mechanical restoration of a military vehicle. You've wrestled around in the dirt and grease and bloodied your knuckles, but you've finally prevailed. Your vehicle runs like it did when the armed forces took possession of it years ago.

The only problem is, it still looks like it barely survived a direct hit during the Tet offensive. Fear not. Victory is at hand. The next part of restoring your machine is the most rewarding, because only when your vehicle looks new, will the rest of the world realize what you've accomplished. In the next few issues of *Military Vehicles* we'll take you through the processes of cosmetic restoration, step by step.

Most military and government service vehicles were painted regularly, again and again and again. Sooner or later, you will have to get all that old finish off and de-rust everything if you are doing a thorough restoration. Read our first installment for some tips and tricks on how to do it. Just sanding and painting over old paint and rust will be a waste of time, because thick paint is prone to cracking, flaking and alligatoring, and underlying rust will begin its evil work again as soon as it gets any oxygen, whether you treat it or not.

In body restoration work, it is vital to plan your strategy before you begin.

Of course, the order in which you do things will depend on what you are restoring. Rust is your major enemy in any case. If you are restoring a jeep inside your garage or shop, you can leave parts in enamel or epoxy primer (not lacquer primer though) for months without fear of corrosion. But if you are working on a larger vehicle that must be left outdoors, you may want to strip, repair, prime and paint one panel at a time, then re-attach it and carefully cover the vehicle with tarps until you are finished.

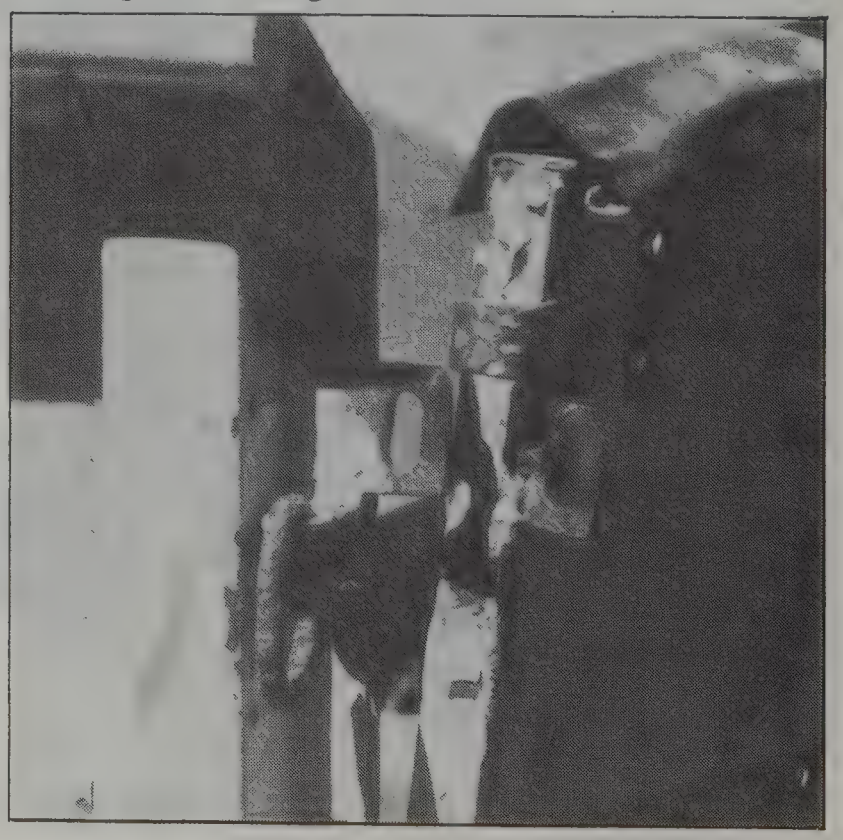
Whatever type of vehicle you are doing, plan your strategy before you begin. Assemble the tools and items you'll need before you start each stage so the part you are working on won't have to sit around and get rusty. Serious surface rust can develop in as little as a few hours even on a dry day. And when it does—no matter what else you do—it will resurface eventually and bubble through your finish.

You may want to grind paint off only in small areas to make repairs, then spot prime in order to avoid rust until you are ready to strip your vehicle. Of course, if you take this approach, remember later not to get liquid stripper anywhere near any plastic filler that you might have used to make your repairs, because stripper will destroy Bondo.

Another possibility is that you may have to heat your vehicle's body panels enough with a propane torch to get undercoating off, in which case you may as well go ahead and strip the part completely, repair it, and shoot it with moisture-proof enamel or epoxy primer and paint it if the vehicle must remain outdoors. In any case, plan ahead to keep rust at bay at all times.

Chemical stripper will clean up glass quite nicely, and won't hurt some of the later, synthetic rubber components that are in good condition—though it may dull them a little. Early, natural rubber parts may start to dissolve if you slather them with stripper, as will many plastics. So if you need to strip rare rubber components, try a little spot of stripper in an area that won't be noticed before going further. Be sure to rinse the item thoroughly with water afterwards.

However, stripping off the old paint and undercoating is just the beginning. In later issues we'll show you how to fill holes, take out dents the right way, patch panels, fill imperfections and shoot paint. This process will take a while, and it will be a lot of work, but it is nothing you can't do at home, and as we said before, the results are very rewarding. So let's don our grubbies and get to work.



Strip Tease

How to strip the paint from your vehicle

by Jim Richardson

If only it were as easy to remove paint from our restoration projects as it is to apply it. Unfortunately, removal often involves grinding, blasting, dipping, chipping, or some combination of these as we attempt to rid our vehicles of all that old paint before redoing them. We have to remove it because when there are several coats on a military vehicle—and there always are—the finish is just too thick and too tenuous to be a good substrate for new paint. That shiny new coat will probably end up cracked and crazed.

If you apply new paint over a bad paint job, you will probably be wasting your time and money, matter how carefully you sand it. Each layer of paint bonds only to the layer under it, so if you don't remove the old paint, your carefully done new work will have a rather loose grip on your machine and will crack, chip, and flake at the first sign of stress.

Ways to Do It

There are several way to remove paint from a vehicle. You can bead blast it off using glass beads and a media blaster, or you can take the parts to a Redi-Strip or similar professional paint stripping business in your area. You can even make your own stripping vat using crystal drain cleaner and hot water. Or you can get a couple of gallons of automotive and aircraft paint stripper from your local automotive paint store or by mail order from The Eastwood Company and strip the vehicle yourself.

Any way you go about it, stripping the old paint from your military classic will be a lot of work. Fortunately, however, it involves minimal skill and can easily be done by a hobbyist working at home.

The important thing to remember as you undertake this project is that *safety is paramount.* Drano is deadly, and aircraft stripper is equally toxic. Either will blister your skin, and stripper will damage your lungs if your breathe it. Bead blasting makes a big mess, and if you don't protect yourself properly, sharp grit will get in your eyes and under your clothing and do serious injury. There is just no clean way to do this job.

One caveat: Don't be tempted to try conventional sand blasting on your old vehicle's sheet metal unless you are doing something extra thick like a gun turret on a tank. Even when blasted by a skilled operator, your parts are likely to come back warped, thinned, peened, and roughened. And in the hands of a novice, sand blasting can be disastrous. The process can cut right through sheet metal and can easily damage panels beyond repair. If you take your parts to a media blaster, make sure they use something other than sand, such as glass or plastic beads, walnut shells, or some other non-destructive medium.

The Drano Method

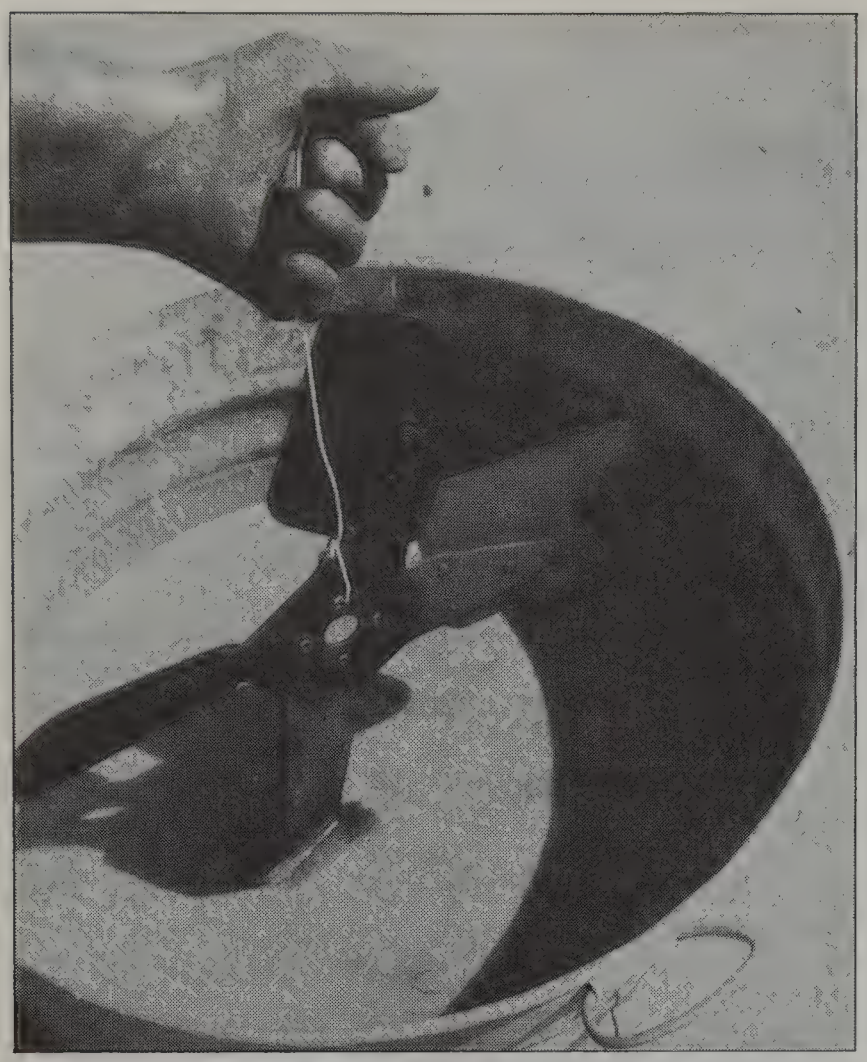
One easy, inexpensive way of stripping paint from the parts that can be removed from your vehicle is to use ordinary crystal drain cleaner and hot water. Restorers have been known to use large, metal horse-watering troughs set on cinder blocks, filled with water, and heated from below by a Coleman stove. When the water is hot, they add ten cans of caustic soda (lye)—also sold as a household drain cleaner called Drano—and throw in vehicle parts.

The process works in 10 to 30 minutes on most parts and strips them easily down to clean bare metal. Afterward, all you have to do is rinse, dry, and paint. A tank like this will work for several days before it needs to be changed or punched up with more lye.

This brew works with cold water too, but is quicker and more effective when heated to between 100° and 120° Fahrenheit. Be sure to wear goggles, neoprene gloves, and thick, protective clothing while working. If you splash any of it on you, rinse immediately with clean water. And never work with such a diabolical mixture around kids or pets. The skull-and-crossbones on the can are there for a reason. This is nasty stuff.

Things you'll need

- ✔ Aircraft-paint stripper
- ✔ Goggles
- ✔ Neoprene gloves
- ✔ Spray-paint mask
- ✔ Cheap bristle paint brushes 2" to 6" wide
- ✔ #80 grit sandpaper
- ✔ Putty knives and Bondo spreaders
- ✔ Plastic kitchen wrap
- ✔ Lots of old newspapers
- ✔ Cloth painter's tarp
- ✔ HVLP spray painting rig
- ✔ DuPont Kwik-Prep and Varaprime primer

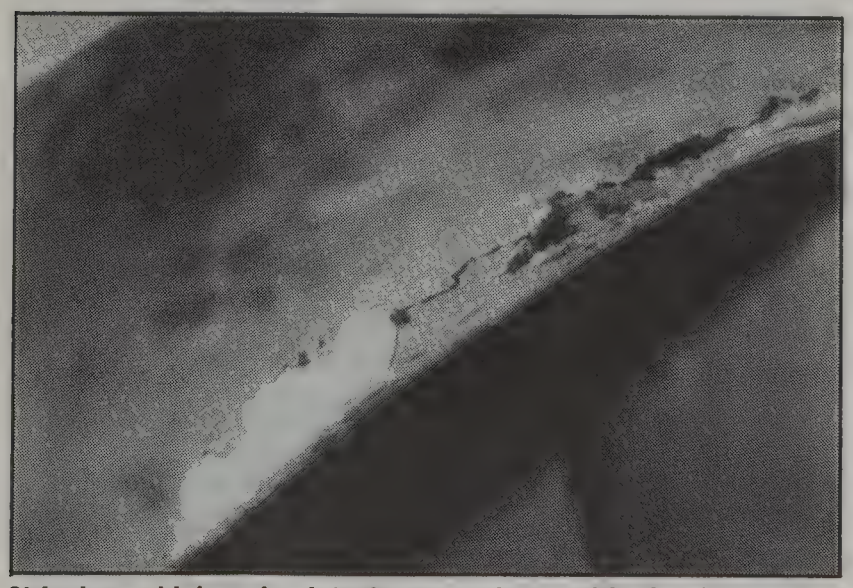


Ordinary Crystal Drano and hot water will strip your parts clean of paint and grease.

Commercial Strippers

If you live near a Redi-Strip facility, you can simply take your vehicle's body apart completely and have it dipped. Everything will come back clean as a whistle, paint- and rust-free, and with a protective coating. You just make repairs and start painting. Just be sure to examine the parts to make sure that the stripper has been removed from every nook and cranny, because any that remains will eat away at your new paint.

Also, any parts made of nonferrous metals such as brass or copper must be removed, because they will be destroyed by the stripping process.



Stripping vehicles of paint often reveals a multitude of past sins. Stripper eats plastic filler, so all of it must be removed and proper repairs made before painting can begin.

Do-It-Yourself Strippers

For most restorers, probably the most practical method of stripping a classic preparatory to painting it is to use one of several of liquid paint strippers on the market. Although the stuff is messy and will burn your skin if it even spatters on you, it offers the easiest way for most of us to strip a machine, especially if you don't plan to take the vehicle completely apart.

I happen to live near a Redi-Strip, so my usual approach is to take bolt-on fenders, hoods, splash pans, and the like to them and have the parts stripped there to save time. Then I use aircraft paint stripper which is a thick, nasty solution that sticks to the sides of the vehicle and eats away the old paint.

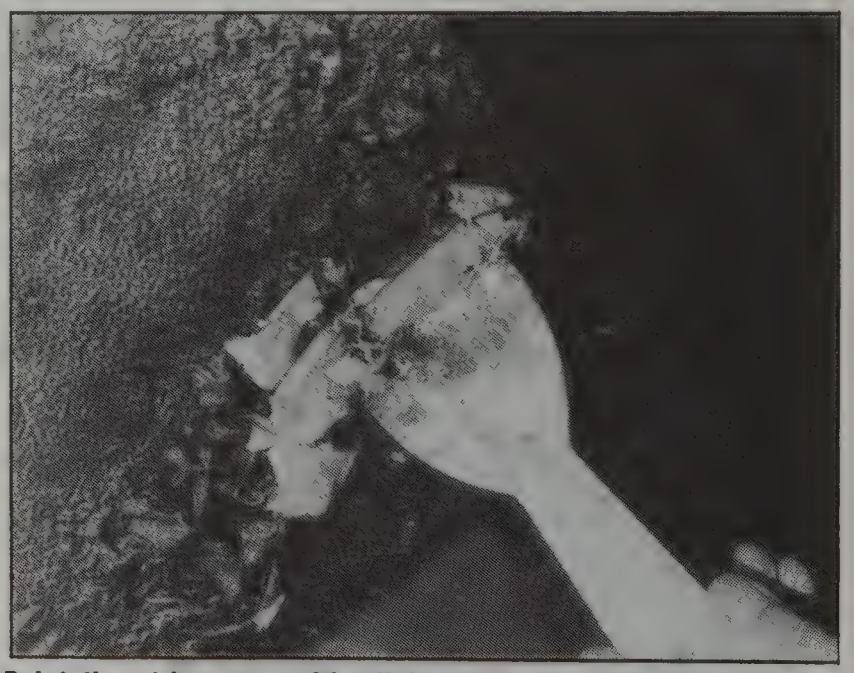
Remove (or mask off) any plastic parts such as instrument lenses, window crank knobs, new style composite light assemblies, and the like; aircraft stripper will dissolve some plastic parts in no time. There is no hard and fast rule for rubber; newer synthetic rubber will be fine—dulled a little perhaps—but older natural rubber may be eaten away. Try a little bit of stripper on a small area before proceeding.

Wash the vehicle thoroughly to remove any grit before beginning to strip it. Work outdoors on a calm day if possible. Good ventilation is a must. Of course, the kids and pets admonition applies here too, because paint stripper is at least as dangerous as Drano. Put a large cloth tarp down to catch the drips if you are working in your driveway or on your lawn.

Put on heavy clothing such as jeans and a sweatshirt, or coveralls. Finally, don a pair of safety goggles and a charcoal-filtered painting mask. Don't be tempted to skip this step. Stripper is so nasty that it can damage your eyesight and even your lungs if you breathe the fumes.

Take It Off

If you are using a spray-type stripper, spray away. For a brush-on stripper, use a cheap, throw-away paintbrush and spread a thick coat on an area about 18" square. Make sure all your brush strokes go in the same direction and that you don't paint over areas to which stripper has been applied. That way you avoid hastening the evaporation of the most potent chemicals in the stripper. If you are working on a



Paint the stripper on with all brush strokes going in the same direction. Don't brush back through your work. It hampers the stripping process. After the chemicals have had time to work, scrape off the bubbled paint with a putty knife or Bondo spreader.

warm day, it is a good idea to cover the applied stripper lightly with plastic wrap or a plastic garbage can lid to further retard the loss of active ingredients.

When the paint has bubbled and the stripper seems to have done all it is going to do(usually five to 10 minutes, but temperature affects the length of time the process takes), lift off the plastic and dispose of it in a trash can with a lid. Now scrape the paint off carefully using a putty knife or plastic Bondo spreader to avoid gouging the metal underneath. Wipe your putty knife or scraper on old newspaper and place the paper in the trash can too.

As for getting stripper off instruments and delicate or intricate items, small plastic Bondo spreaders and even rags will work. Again, let me emphasize, don't hit any plastic lenses or other parts with the stripper.

If your vehicle is WWII or Korean War vintage, it will have been painted many times, in which case you will probably not get down to metal the first or even second time you apply the stripper. Work one part at a time until you have all of the paint off, then go on to another. Use strong twine to get the stripper down into grooves.

As you continue the stripping process, you may find places that are covered with or contain plastic filler. These must have the filler taken out and replaced, because stripper destroys Bondo. You can grind it out with a grinder and #80 grit sandpaper or just remove it with repeated applications of stripper.

If you don't finish your stripping job all in one day, rinse the areas you have worked, and wrap them in cheap plastic tarps to protect them against moisture. This is important, because even in dry weather, bare metal rusts quickly.

When your parts are completely stripped, rinse them thoroughly with clean water, making sure to get every bit of stripper out of every groove and fold. Remember, any trace of stripper left behind will eat away at your new paint and ruin your work. Dry your parts thoroughly.

Prepare It

Make any repairs required. It has been my experience that you don't really know the extent of the repairs that will be required on an old vehicle until you strip it. Paint can hide a multitude of sins, including rust and badly done previous repairs. When you have everything the way you want it, go over your parts with #80 grit dry sandpaper to give a tooth to the metal. Finally, use a good metal-prepping solution like Kwik-Prep to etch the metal and convert any unseen rust.

As soon as your vehicle's parts are stripped clean, you must apply metal prep to kill minute rust specs and etch the metal for painting as we have done on the top part of this piece.

Prime and Paint it

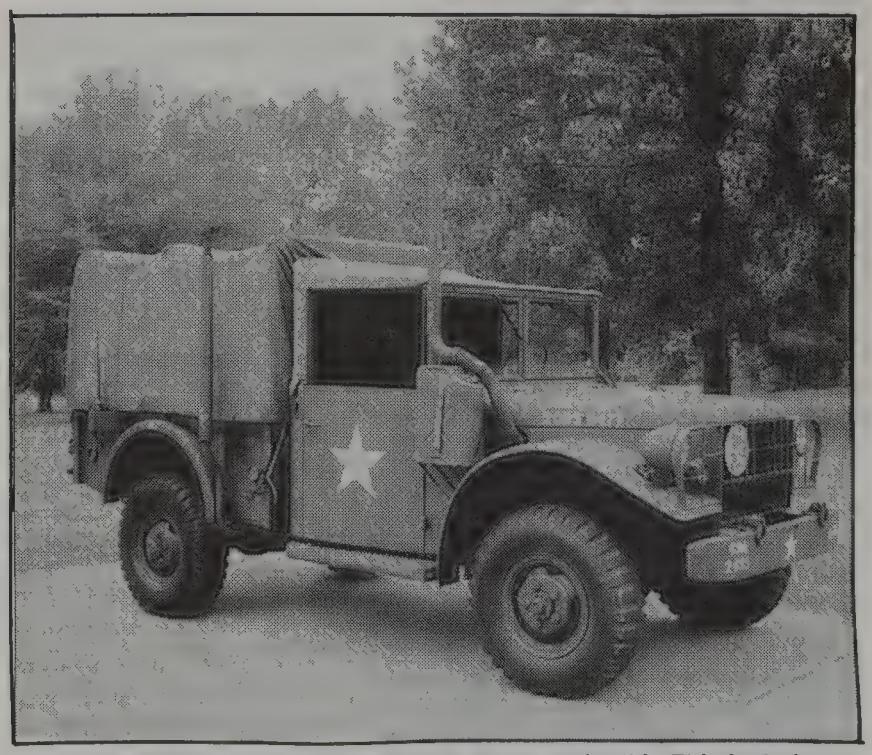
It is important to protect all the parts you have stripped as soon as possible. if you don't, you will soon have to contend with surface rust that will eventually bubble and eat through your paintwork. One of the best products for this purpose is DuPont's Variprime.

Variprime is not a thick, surfacing primer that you can sand. Instead, it is a two-stage etching primer that bonds with metal like you wouldn't believe. It protects your parts from rust until they are ready for finishing, and it creates a perfect surface for your final coats. Follow the instructions on the bottle, and let your parts cure indoors for four or five days before going any further in order to allow any accumulated gasses to dissipate. "Indoors" is a key word here; if you plan to leave your vehicle any length of time before doing the final painting, Variprime is not designed to provide outdoor protection. Nor, for that matter, is any other primer with which I am familiar.

No matter how you do it, stripping is a messy, ugly job. But just remember, when you have finished stripping the old paint from your military vehicle, the worst is over. The next steps are body work and metal finishing. Then comes painting. Shooting color requires developing a little skill, but the results are extremely rewarding.

Next issue: Body Work Basics

Resource: Eastwood Company, PO Box 3014, Malvern, PA 19355, 800-345-1178.
Note: Bondo is a trademark of the RPM Corporation.



This 1952 M37 is equipped with a deep water fording kit. This includes a high air intake for the carburetor and a high exhaust stack. People often wonder what the bracket on the front right side of the bed is for and this is it. Normal fording depth for an M37 is 42"; the fording kit increases this to 84" (seven feet!). For all fording operations, the crankcase shutoff valves should be closed and the hand throttle pulled out to prevent stalling.

HOW TO...

Basic Bump and Grind

Part 2 in our series on body work

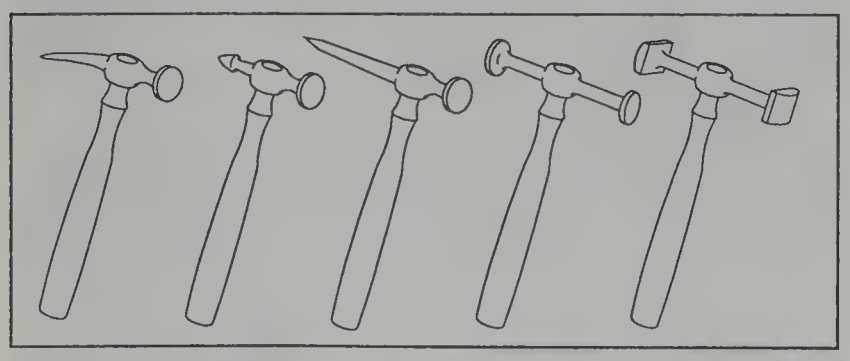
by Jim Richardson

When I was about six years old, I remember watching my father take dents out of an old Chevy sedan he had purchased. First he knelt down by each fender and looked at it from several different angles. He closed his eyes and ran the palm of his hand slowly over the surfaces. Then, when he found a dent, he selected a strange looking hammer from a group of several he had and picked up a rounded lump of steel in his other hand. With the lump of steel behind the fender, he would do a few taps on the surface using the hammer. Then he would look things over again.

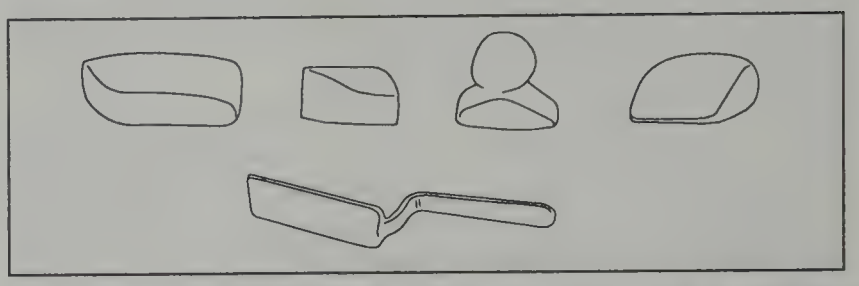
He kept this up all weekend. By the time he was ready to drive to his job as a spray painter on Monday, his car was ready. He rode to work with a friend the next day. Then two days later, when he brought the old Chev home, it appeared transformed. It had a glistening paint job and looked like new. Among other things, my pop was a master body and fender man. He had even worked for the great Dutch Darrin for a short time. He knew how to make any old wreck look good.

In my late adolescence I acquired my own old Chevy, and remembering my dad's magic, attempted to do the same thing to it. The old man had made the process look so easy that I didn't even bother him with questions. I knew where he kept his body tools in the garage (He had long since given up panel beating for greener pastures in the aerospace industry) so I dug them out and started pounding.

It was a disastrous mistake. I managed to turn a few fairly subtle dents into big, hideous bulges filled with little dings and dimples. As I gazed at my car with increasing despair, I heard his voice: "What in hell are you trying to do?" My banging must have roused him from his pipe and paper. He indulged himself in a hearty laugh, then sat me down and



Some typical body hammers. From left to right: 1) Curved pick hammer which is good for reaching into hard-to-get- places, such as behind reinforcing braces. 2) Short utility pick hammer. Good for tight spaces. 3) General purpose pick hammer. This hammer is easy to use and has a good balance. Head has a low crown. 4) General purpose dinging hammer. The large face is used for hammer-on work. The small, high crown head is for hammer-off work. 6) High crown, cross-peen hammer. Used primarily for concave areas.



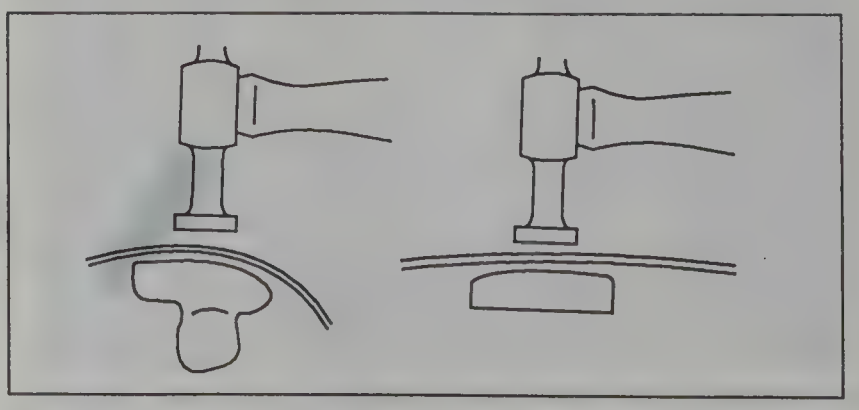
Some common dollies: 1) Toe dolly. Flat face is used for working flat panels, curved face for low crown surfaces; also used for roughing out a dent. 2) Heel dolly. Good for reaching into tight corners. Can be used for high crown panels. 3) General-purpose dolly. Because it is easy to hold and can be used on a wide variety of surfaces, this is a useful addition to the body worker's kit. 4) Utility dolly. Good for high crown work; edges are good for tight radii. 5) Body spoon. Used as a dolly in tight places. Good for spanking dents out from behind. Also good to spread the impact of a hammer on flat surfaces.

explained the facts of life. At least the facts of a body and fender man's life. What follows is the meat of his lesson.

Tools

Metal finishing is an art. It's not something you just do. It takes practice. Practicing is the only way you can learn the control necessary to do a good job. On the other hand, I'm living proof that if you can drive a nail without bending it, you can learn metal finishing. To begin with, you need the right tools. Body hammers and dollies (those little, hand--anvils used for backing and shaping sheet metal) are the main ones, and they are highly specialized. The designs of these items go back hundreds of years.

They were first used by tinkers—people who repaired pots and pans. Tinkers in the old days made their own tools, which evolved over time as the tasks changed. (Incidentally, tinker's dam refers to clay dams that tinkers used to back holes they were patching so the molten solder wouldn't run out. Such a dam could only be used once; it was worthless after that. Hence the phrase "not worth a tinker's dam.")



Use a high crown dolly for high crown surfaces and a flatter dolly for low crown surfaces. The dolly should be approximately but not exactly the same shape to avoid flattening and spreading metal.

Today most body and fender pros have upwards of a dozen hammers, several bumping dollies, body spoons and files, and probably a lot of other things to make their jobs easier.

You won't need that many items to get going though, or to fix a few small dents. To begin you'll need a minimum of three hammers, three dollies, a body spoon, and a vixen file. The three hammers are a combination hammer for general work, a long picking hammer for working in tight places, and a short picking hammer for taking out door dings. The dollies to start with are a toe, a heel, and a general purpose. You can pick these tools up at your local automotive paint store or order them from The Eastwood Company.

Which dolly is right for which task? Dollies that approximate but are not quite the same shape as panels are used to remove low spots. Use a flatter dolly for low crown (slightly rounded) panels and a rounder dolly, such as a general purpose dolly, for high crown panels. Incidentally, the edge of a body spoon can be used to back hard-to-get-at grooves and fender lines.

Which hammer is right? Picking hammers are good for getting into tight places, taking out small dents, and working raised lines in metal. A high crown, cross-peen hammer is good for tight, concave curves. With a general-purpose dinging hammer, the larger head is for hammer-on work, and the smaller head is for hammer-off work. A short, beefy, heavy-duty bumping hammer can be used for roughing out dents, but a dolly usually works better for this job, and a roughing hammer in the hands of an inexperienced person can do a lot of damage.

Technique

You can add tools as necessary, but first let's practice a little with what we have. Find a block of a soft wood like pine, short end 2x4 from a construction site for your introductory blows. Holding a general-purpose dinging hammer loosely about three quarters of the way up the handle from the head, practice tapping the block of wood using only wrist action and the opening and closing of your fingers to swing the hammer. Keep in mind that metal finishing is not carpentry. Very little muscle but lots of control are what you need to do it right.

If you are getting your arm into your swing, you're tapping too hard and you'll end up making dents in your vehicle instead of taking them out, much as I did when I attempted to fix my old Chevy. Tap gently, with the hammer head landing perfectly flat, so that you are not even denting the wood yet. Now increase your effort until the wood starts to dent. You should be making perfect circle indentations that are no deeper along one edge than the other. Keep practicing until you can make clean circles easily.

Now you're ready to practice on metal. Take a trip to your local body shop or junkyard and talk them out of a damaged fender that they will be discarding. Or pick up a cheap one at a swap meet. Don't get a part from a modern Japanese import though, because they are thin and made of high-carbon steel which is nearly impossible to work; also it's totally different from the metal used in military vehicles. Don't even think about pounding on your restoration project before you've practiced on junk parts and until you are relaxed and confident.

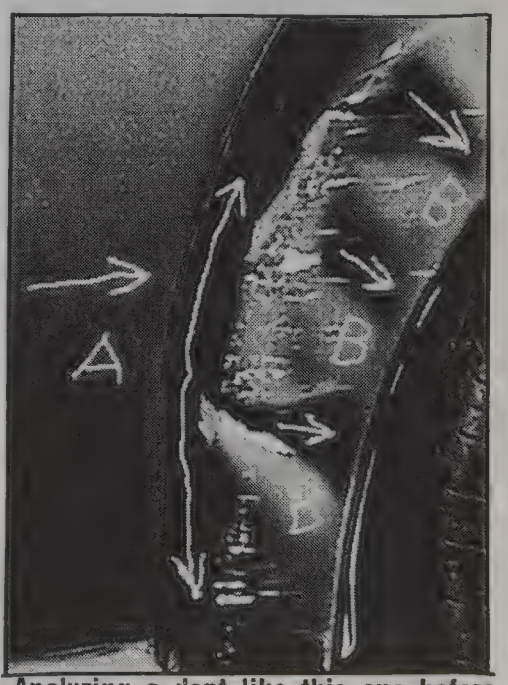
Analysis is important! This dent is the result of a direct impact at A. If a skilled body man starts working there, much of the other metal will pop back into place thanks to the stresses created in the panel by the stamping die when the part was manufactured.

Removing dents from body panels is not just a matter of pounding deformed metal back into shape. It's more like unfolding a map. It has to be done in the proper sequence to avoid worsening the damage. Determining the correct working sequence was what my dad was doing when he got down and looked at every dent from several angles before starting to work.

When repairing any damaged vehicle sheet metal, you must first analyze the sequence in which the dent happened. That's because you need to take out the dent in the reverse order of its occurrence. And that means relieving the deepest primary impact first and then dealing with the interlocking cross ridges and valleys. You see, auto body panels are stressed by stamping dies when they are made at the factory, and as a result, most of a dent will pop back to its original shape when the stresses caused by the interlocking creases and ridges are relieved by working the primary impact.

Broad Dents

The damage shown in the photo of a VW Bug fender proceeded from front to back across a broad plane (A) and was probably caused by a collision with the corner of a building or wall. As the car traveled forward, the fender was crushed inward, and as a result, several deep channels were formed because the metal had no place to go. An amateur would just start banging on the damaged metal from behind, hoping to batter it back into shape. The next photo shows the results of such a strategy.



Analyzing a dent like this one before starting to work can make its removal much easier. The impact on this fender happened across a broad area and proceeded from front to rear, causing the metal to pucker into valleys.

The result of an amateur attempt at bashing a dent into submission. The work is long on enthusiasm but short on technique. Even gobs of filler wouldn't help this mess. This panel could have been saved by a skilled person, but now it will have to be cut off and replaced.

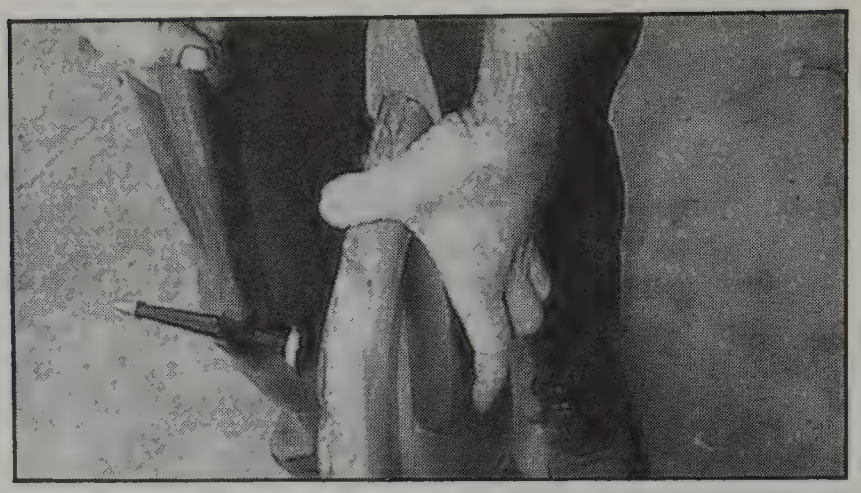
A body and fender pro would use a more analytical, and far more effective, way to deal with this dent. First, he would take the wheel off the car and carefully clean all dirt and undercoating from behind the dent. He would then begin by slapping the dent from behind with a dolly of approximately the same curve as the fender along the rough area just behind the crease at the up-and-down arrow A where the impact reached its deepest point. In doing so, he would move the fender closer to its original shape, and he would probably pop out most of those interlocking ridges.

Then he would use what is known as the hammer-off technique to work out much of the rest of the dent. The hammer-off technique involves putting the dolly on the dent and then tapping on the raised edges of the dent with a body hammer. The dolly transfers the energy to the dent and pushes it back out.

The hammer-off technique transfers force to adjacent metal. It's good for lowering ridges.

Next, a pro would look over his work carefully and feel the dent with the palm of his hand. After that he would use the hammer-on technique, which involves backing the metal with a dolly and hammering directly on the dent, to take out high spots. Then he would finish up with a picking hammer to take out the small dimples.

Use your scrap fender or body panel to practice these techniques and perfect your control. With the hammer-on technique, when you are hitting squarely on the dolly, you will hear a healthy dinging sound. Remember to wield your

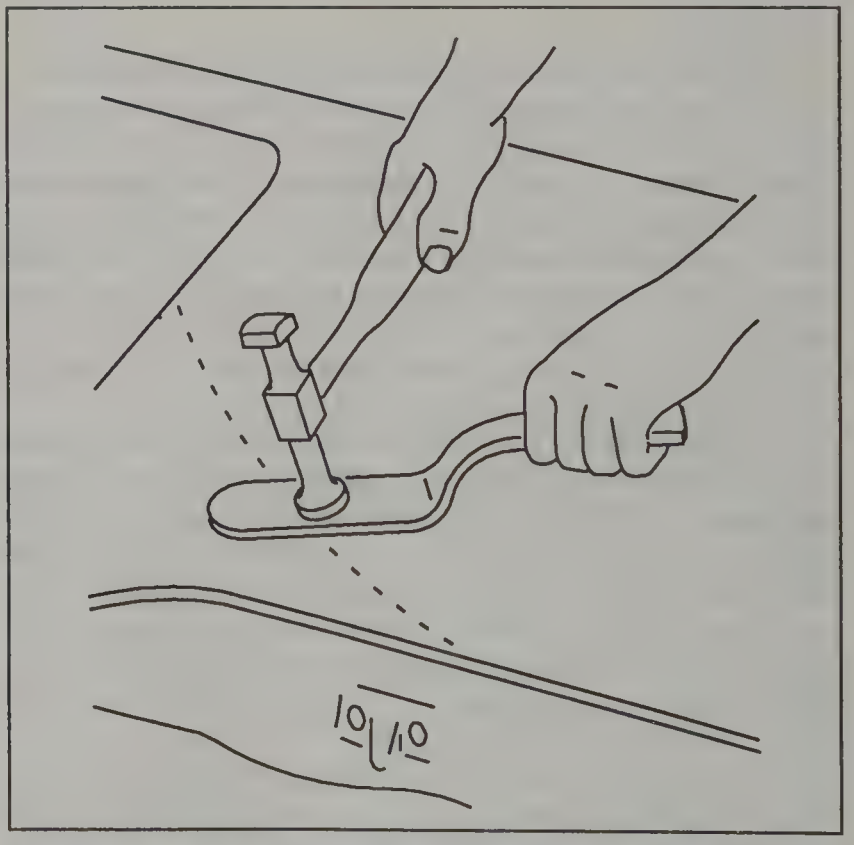


The hammer-on technique is usually used to raise low spots. The trick is to strike the metal cleanly and in the right place. You will hear a satisfying ring when you do.

hammer only from the wrist and by the opening and closing of your fingers. Your blows should start from a couple inches away and rebound only about a quarter of an inch. The head of your hammer must land flat. Otherwise, you'll succeed only in adding to your problems by making a series of little, half-moon or triangle shaped dimples.

Low Crown Panels

Large, flat, or low crown panels that are hard to get at can be worked using a body spoon. A spoon can be used to reach behind reinforcing braces to spank out low spots and can be used directly under a hammer to help spread the force of your blows to take down high spots in low crown surfaces.

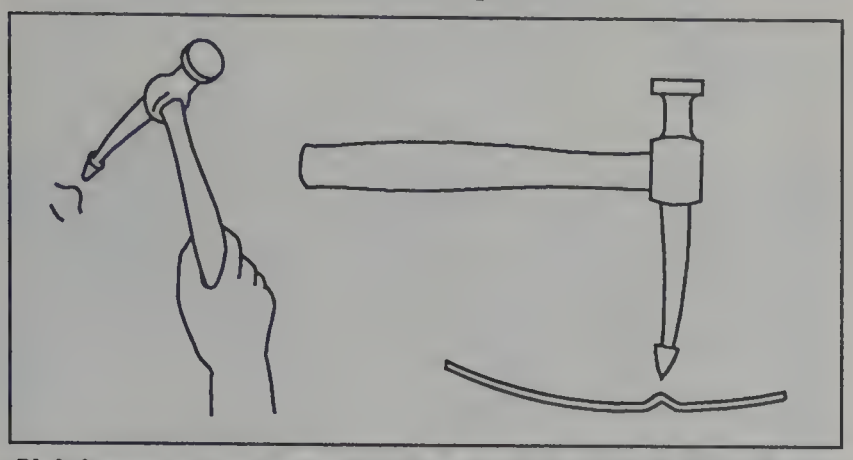


A spoon can be used underneath panels in tight spots to spank out shallow dents and to distribute blows across a low crown panel to flatten ridges.

Door Dings

Picking hammers concentrate a great deal of force on a small area of metal. They are used to take out low spots and door dings. It takes practice to get the hang of tapping

directly onto the high point of a door ding. Try holding the tip of your finger over the dent to help you locate it. When you are pretty good at hitting the center of the ding, try backing it with a dolly. If you don't practice this technique adequately, you will end up with new dings that stick out alongside the ones already in the panel.



Pick hammers concentrate a lot of force on a small area and are good for small dents and door dings. It takes practice to use one of these effectively.

Remember to take it easy and work methodically. Restoring the body of a military vehicle doesn't require Pebble Beach level body work, but it must be right. Use a straight edge to check straight surfaces like the sides of jeeps, doors, and truck beds; and don't get so carried away with pounding that you stretch the panel.

Resource: The Eastwood Company, 580 Lancaster Avenue, P.O. Box 3014, Malvern, PA 19355-07141, 800-345-1178.

Unit Markings on Vehicles

by David H. Ahl

How to apply unit identification of military vehicles is set down in several military manuals (TB 746-93-1, Oct. 1964, TB 43-0209, Oct. 1976 and Oct. 1990) yet many owners get it wrong. It is one thing if you decide to mark your vehicle with the name of your local MV club or the designation of the vehicle itself, but if you plan to use unit markings, you should do it correctly.

Type Font

First of all, the type style is gothic. On your computer, if you have one, the Truetype font is called Franklin Gothic Medium and it looks like this.

CORRECT FONT FOR VEHICLE MARKINGS

Stencil type, which is so popular among vehicle collectors is just plain wrong. You may apply your markings with stencils, but the tiny pieces that hold the letters together should be filled in like this.

WRONG WRONG RIGHT

Markings may be applied with paint or vinyl letters. Sets of vinyl letters are available from office suppliers like Staples or Office Max. Letter sets do not come in Gothic, but the Helvetica font is very close.

Unit Identification

Unit identification markings are divided into four elements arranged from left to right. On vehicles with larger bumpers, the unit markings can go on a single line of characters of no more than 4" in height. On short bumpers such as the winch bumpers and rear bumpers of an M37, the unit markings may be put on two lines of 2" high letters.

The first two elements appear on the right side of the bumper or on the right bumper, specifically: 1) Major command and 2) Intermediate organization or activity. The other two elements appear on the left side: 3) Unit or activity and 4) Vehicle number.

Rather than give every possible marking (as are listed in the manuals), here are just the most common markings as you might find on a typical jeep or truck.

Major Command, Organization or Activity:

1. Army. Arabic numeral followed by A.
2. Corps. Roman numeral only.
3. Command.
4. Army Reserve Command. Arabic numeral followed by C-R.
5. Group. Arabic numeral followed by GP.

Intermediate Commands, Organizations, or Activities:

1. Corps. Roman numeral only.
2. Division. Arabic numeral followed by service designation
   a. Airborne. AB (pre 1976) or ABN (after 1976)
   b. Amphibious. APH
   c. Anti-aircraft. AA
   d. Armored. Equilateral triangle with base down.
   e. Cavalry. CAV
   f. Armored cavalry. Equilateral triangle with base down followed by CAV.
   g. Chemical. C
   h. Engineer. E
   i. Field Artillery. F (pre 1976) or FA (after 1976)
   j. Infantry. I preceded by a dash 1" long
   k. Mechanized. MCH
   l. Medical. M
   m. Military Intelligence. MI
   n. Military Police. P
   o. Ordnance. O preceded by a dash 1" long
   p. Quartermaster. Q
   q. Signal. S
   r. Transportation. T
3. Brigade. Arabic numeral followed by BG (pre 1976) or BDE
4. Group. Arabic numeral followed by GP
5. Command
6. Division Support Command. DSC
7. Battalion or Squadron organic to a larger force. Arabic numeral designating the battalion/squadron, followed by a slash(/), followed by the arabic numeral designating the larger force, followed by the appropriate service designation (#2 above).
8. No intermediate organization or activity. X (pre 1976)

Company, Battery, Other Small Unit or Activity

1. Automatic weapons. AW
2. Direct Support. DS
3. General Supply. GSP
4. Light Truck. LTRK
5. Reconnaissance. R
6. Service. SV
7. Support. SPT
8. Headquarters and Headquarters Company. HQ
9. Transportation Motor Pool. TMP
10. Organization already fully identified. X (pre 1976)

Vehicle Number in Unit

In tactical units, vehicles will be numberd in the sequence of their normal order of march. Vehicles in administrative use or assigned to motor pools may be numbered in any appropriate sequence. Trailers are marked with the number of the vehicle that normally tows them, preceded by the letter T.

(Unit Markings continued on page 111)

HOW-TO...

Patch Panels for Doing Battle With Rust

by Jim Richardson

None of our military machines were their original owner's pampered darlings. They got good maintenance, but they were also expected to slog through mud, ice, and whatever else the armed forces encountered along the way. As a result, most of them have had to endure the insidious attacks of a very powerful enemy—rust.

If you're doing battle with corrosion in your restoration, you'll want to defeat it once and for all, because even if you are just refurbishing your vehicle, you won't want rust eating away at your efforts. And if you are doing a full restoration, you will want to strip your machine's sheet metal of paint and rust and repair any damage.

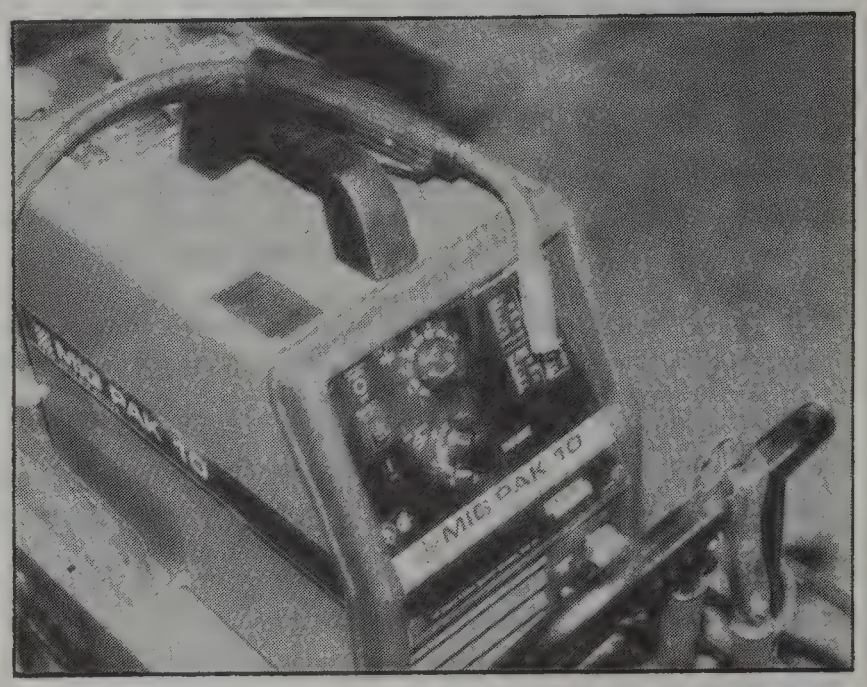
On some vehicles, those welded-on, rusty panels and those rotted floor pans will have to be cut out and replaced with good metal. There is really no other choice. Rust can be neutralized and stopped temporarily, but as soon as it gets any oxygen, it will start growing again. Besides, rust weakens panels whether it is neutralized or not. The only effective way to do away with heavy rust is to cut it out and replace it with healthy tin. Luckily, the job is fairly easy to do.

Hobbyists can install panels in a number of ways, including brazing, welding, and even pop riveting them on. Brazing isn't as strong as welding, and pop rivets require lap joints that are subject to corrosion in the unprotected metal of the lap. So by far the best method is to butt weld patches into place. In the past, the problem for many of us was that the job had to be done with an oxy-acetylene torch, and torch welding was difficult to master.

Not too many years ago, torches were all there was to work with. In skilled hands they produced outstanding results, but acquiring the skill to use them took a long time and meant spoiling, warping, and melting a lot of sheet metal in order to get the hang of it. Then MIG welders came along. Nowadays even most body shops rely on them. MIG welders don't produce an aesthetically pleasing weld, but they are simple to use and the welding done with them is just as strong as that done with gas.

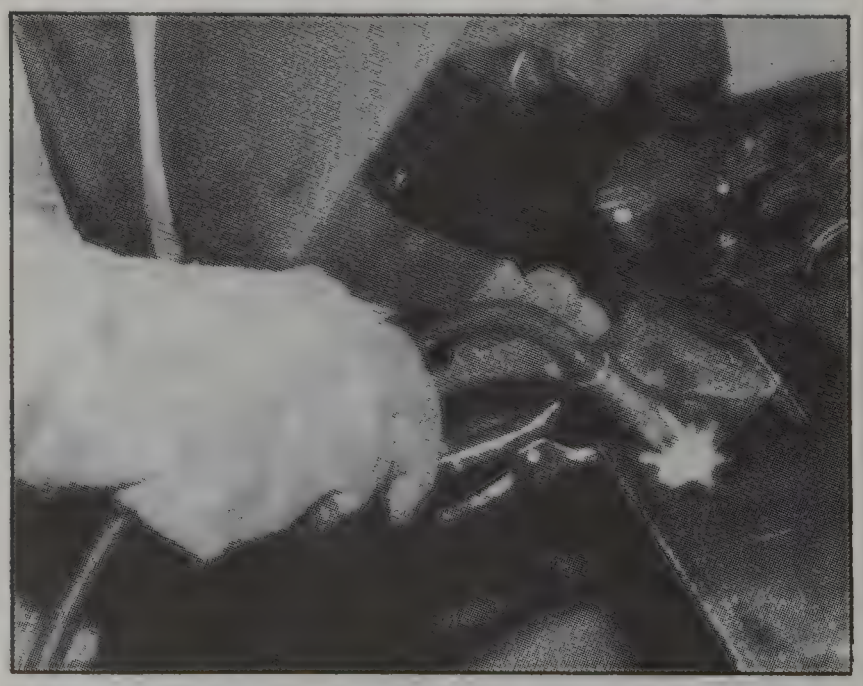
Things You'll Need

- ✔ MIG welder
- ✔ Heavy leather gauntlet gloves
- ✔ Welder's mask
- ✔ Welder's hat
- ✔ Aviation tin snips (right and left)
- ✔ Aircraft metal stripper
- ✔ Scrap sheet steel of the same gauge and carbon content as that of your vehicle
- ✔ Thin cardboard
- ✔ X-acto knife
- ✔ Awl for scribing
- ✔ Fine marker pens
- ✔ Grinder or vixen and other coarse files

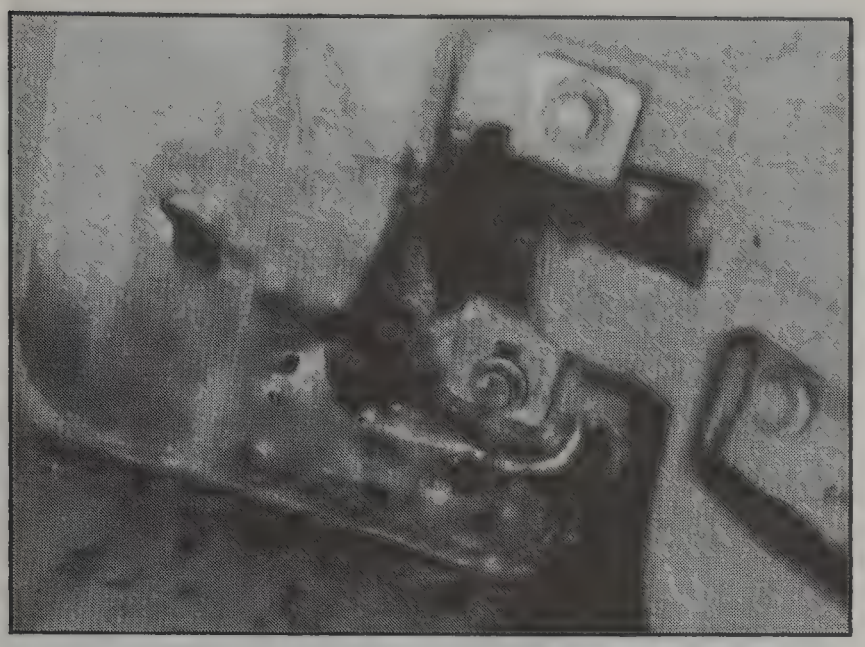


A Lincoln MIG PAK 10 welder will work on 110-volt household current and is a breeze to use.

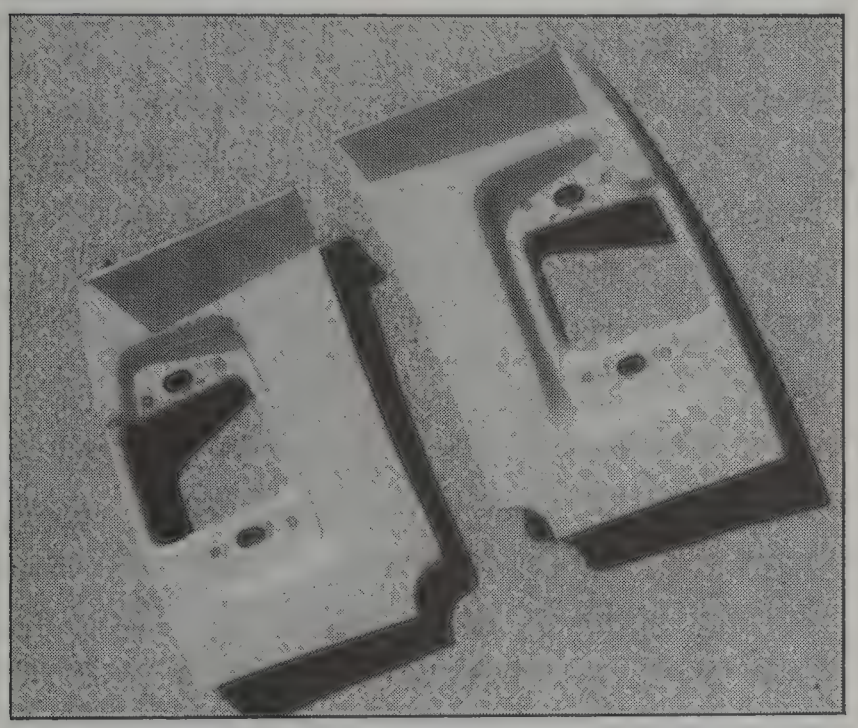
MIG welders for home use range in price from around $600 for a light-duty model that will operate on standard 110V household current to $3000 and more for a large, heavy-duty, professional model. For the hobbyist restorer, a light-duty rig like as the Lincoln MIG PAK 10 or the TiP Tools MIG 110 is fine. The PAK 10 even comes with a video tape that will get you up and running in no time. After a few hours of practice on scrap metal to get the wire feed rate and the angle of the nozzle right, you'll be ready to go to work.



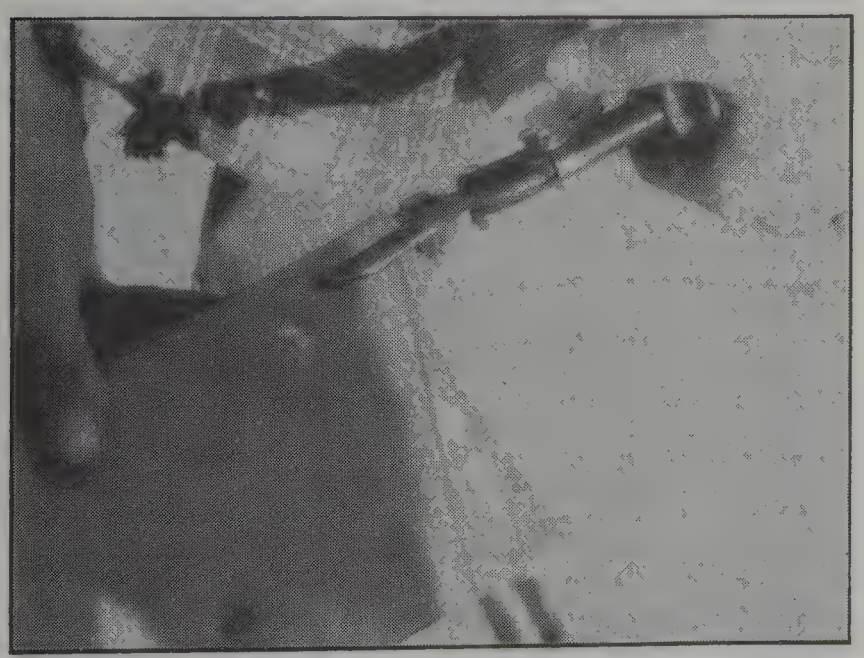
Practice welding until you can lay down a nice, even bead without melting the metal, but with good penetration. Practice lap and butt welds as well as right angle welds until you



This is the lower, driver's side hinge panel on the author's pick-up truck.



There were patch panels available for my truck, but you may not be so lucky, in which case you may have to make your own.



Heavy-duty, aviation tin snips are ideal for cutting out patches from new steel.

Of course, if you are doing an armored vehicle made of very heavy-gauge metal, you will want a heavier-duty rig.

Keep in mind at all times though, that electric welding can damage your vision if you don't protect your eyes from its brilliant glare; and any kind of welding can spatter you with molten metal, so wear leather welder's gauntlets and a face mask that offers the correct level of protection for the work you are doing (sunglasses may look cool, but they offer no eye protection when welding). And if you value your handsome pompadour, a welder's hat is a good idea too. Finally, while you are welding, keep a fire extinguisher and a first aid kit handy.

If you decide to use scrap metal from a junked vehicle for your patches, you will need to strip off all of the old paint, dirt, and grease before you attempt to use it. Heavy-duty aircraft paint stripper will do the trick, or you can strip small panels in a metal bucket using hot water and crystal drain cleaner (lye). Wear goggles and neoprene gloves while working, and don't let kids or pets anywhere near this corrosive witch's brew. Rinse the panel thoroughly with clean water, dry it, and remove any surface rust before starting to work.

Patch panels must be made of the same gauge (thickness of steel) as your vehicle's body, and they must have the same carbon content as the original too. There are more exacting ways to determine carbon content, but usually, if the replacement metal spits the same colors and types of sparks as the original when touched with a surface grinder, you will be okay as far as carbon content goes. If you feel uncertain about recognizing the types of sparks different metals give off, hit a few pieces of scrap metal around your shop with a grinder. You'll be able to discern the difference.

If you try to patch your vehicle with metals of different carbon content, as you weld, one will melt while the other is just getting hot. Also, the two metals will have different characteristics when you try to work the repaired panel. I am currently patching the body of a pick-up truck, and I found that an early '80s Audi hood was perfect for my needs. It was the right gauge and had the correct carbon content. Of course, you can buy new sheet steel from metal dealers too.

Be sure to butt weld in patch panels on your vehicle's exterior because lap welds, though easier to do, are prone to rust and stiffen the metal in odd places, keeping it from flexing in the area where it is overlapped. Eventually, as the patch ages, the lap joint may start to show as a line in the body of the vehicle. Also, more filler is required to make lap-welded patches look good. However lap welds are fine for floors, inner panels, and other places where they can be protected with undercoating.

Templates for patch panels can be made out of shirt cardboard or cardboard boxes. A block of wood and an X-acto knife are all you need to cut one out. An old-fashioned cloth tape measure is good for determining dimensions, and if you run into any trouble figuring things out, ask someone who sews to help you. Patterns for clothing that has to fit the human body are made the same way as patterns for vehicle bodies.

There are several ways to make a pattern for a patch panel. Perhaps the easiest is to make your pattern before you cut into your old panel, then use it as a template to cut out your corroded metal. To allow for curves in your cardboard

template, lightly scribe the back of the cardboard at regular intervals so you can bend it to the correct radius. Tape your panel pattern into place and examine it to make sure it is what you want before starting to cut the old metal.

When you have your pattern just right, place it on your sheet metal and scribe around it. If you are using an old hood for patches, cut out a small, manageable piece to work on before tracing your template. Then cut out your new panel using aviation tins snips and leaving about ¼" surplus all around.

If you need to make sharp, 90° bends, you can place a couple of soft blocks of wood such as scraps of a 2x4 in a vise and then use a third piece to gently bend the metal over. An oxy-acetylene torch or even a propane torch can be used to heat the metal and make it easier to shape.

If you need to make a gentle curve, a piece of scrap wood can be shaped to the correct radius; then your sheet metal can be tapped over it using rubber or plastic mallets or body hammers and dollies. You can also order a shot bag on which to shape your panel from one of the specialty houses. A shot bag looks like a leather throw pillow, but it is filled with buckshot. You can even make a less durable but no less effective shot bag out of heavy canvas filled with sand.

A saber saw is best for cutting out panels, but a die grinder with a cutting wheel or good quality aviation tin snips (you'll need both right- and left-bladed) are also good for cutting out rusted panels. An oxy-acetylene cutting torch is not satisfactory for this job because it will leave ragged edges and warp the metal.

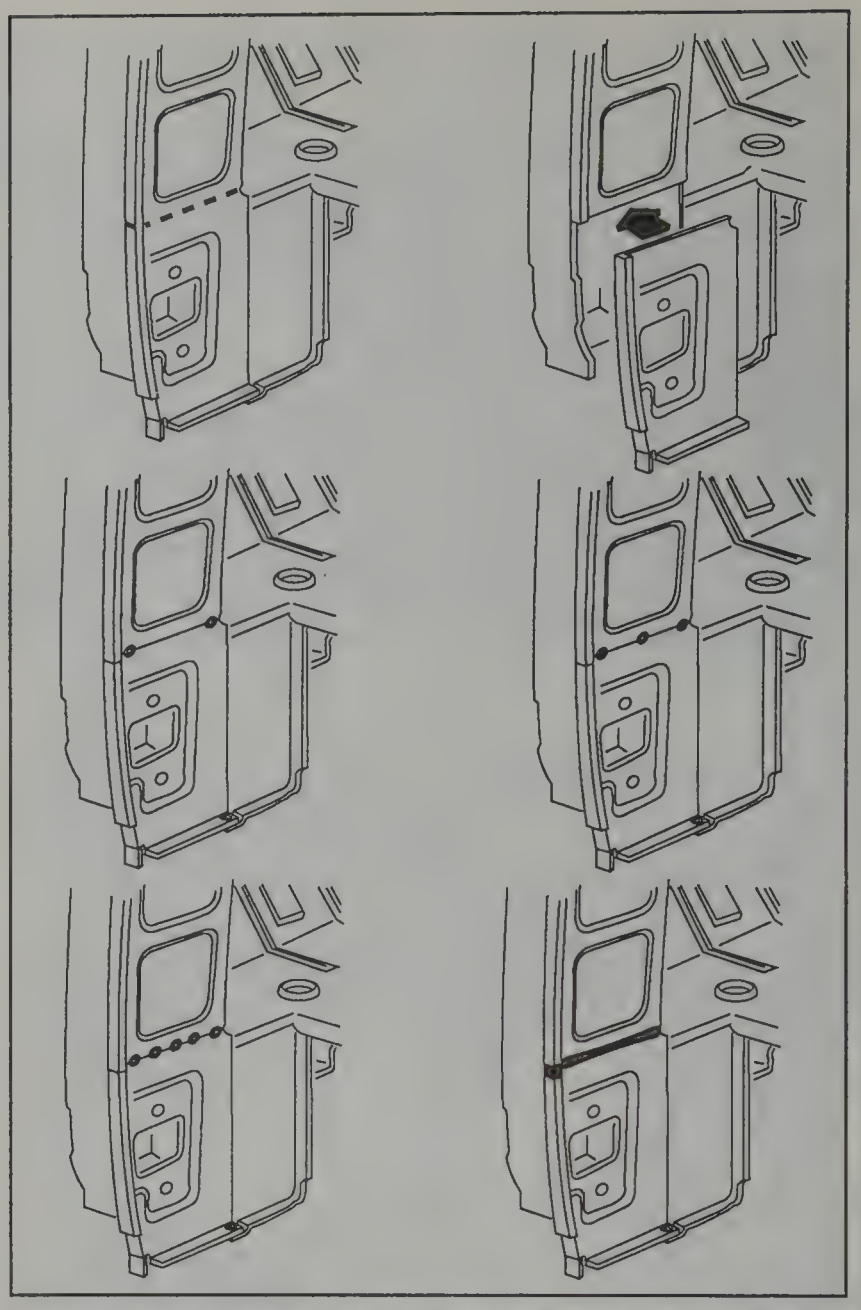
Cut your patch panel a little larger than it needs to be, so you can clean up the cut edge on the vehicle with a grinder or file. Then and clean up, trim, and fit your patch panel precisely. This part of the process calls for patience and care. Make sure contours line up exactly. Nothing looks worse than a kick panel that goes straight, then suddenly veers up or down.

For welding, hold your panel firmly in place using C-clamps or specialized vise grips made for the purpose. Now tack or spot weld the ends of long cuts and wherever necessary to hold the panel in place. Step back and double check your alignment. If anything is cockeyed, now is the time to fix it. You can easily grind off a couple of tack welds and make corrections at this point.

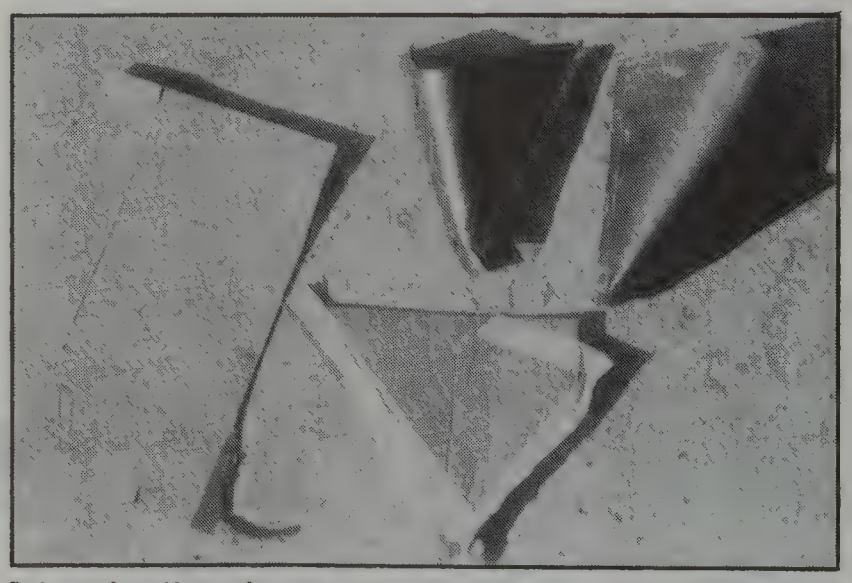
Next, tack your panel in place in the middle of cuts or seams. Keep alternating from end to end around your patch tacking as you go, until your spot welds are about ½" apart. Now take a dolly and hammer and work out any warping.

Finally, weld your patch in place a half inch at a time, alternating between sections so you don't over-heat and warp any one area. Use a dolly and hammer to help flatten each half inch of welding as you go, so you will have less finishing work to do later.

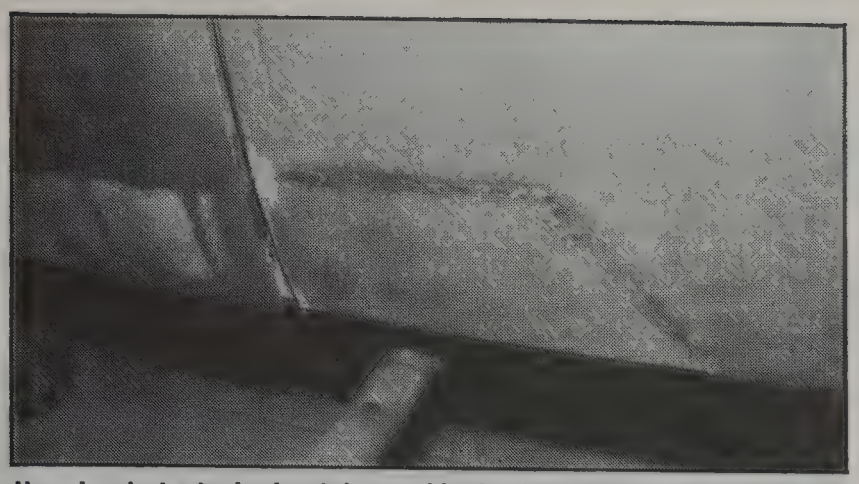
Let the area cool, then file it smooth with a course, vixen file or a grinder. Use a hammer and dolly to work out any warping or low spots. Finish the panel cosmetically using either plastic filler or lead. (If you plan to use your vehicle off-road, you may not want to use plastic filler, as it will crack when flexed.) A body spoon is good for flattening warped panels and can be used to do final shaping. When you are finished working the metal, make sure you shoot the panel with a little water-proof enamel primer before you turn your



On the author's pick up, the old panel will be cut out. Then, the new panel will be tacked in at a couple of critical places to align it. Next, the panel will be spotted in, working back and forth across the seam in order to let it cool, until the tack welds are about ½" apart. Finally, the panel will be welded in a half-inch at a time moving back and forth across the seam to avoid warping the panel.



Cut patch patterns from cardboard using an X-acto knife. When you have them right, use them to cut out your new patches. These pieces for our pick-up were shaped using wood blocks and rubber mallets, as well as body hammers and dollies.



Here is what a typical patch panel looks like after it is installed. The welds have been hammered while hot in order to make metal finishing easy.

attention to other work.

Incidentally, if you find that you need to replicate spot welds for lap joints, you can drill small (1/16" would be typical) holes in one of the panels where the old welds would have been, then spot-weld the panels through the holes using your MIG welder. The effect is quite convincing.

Also, if you need to weld holes—and who doesn't when restoring an MV—the easiest way is to use a small copper paddle from behind, then weld the hole from the front with a MIG welder. The welding rod won't stick to the copper.

That's about all there is to it. You can make even a real rust bucket whole again with enough patience and a couple of sheets of new metal. Practice before you start; don't try to hurry; and you too can work wonders with your military vehicle's body work.

Source: TiP Tools, PO Box 649, Canfield, OH 44406, 800-321-9260.

Unit Markings on Vehicles, continued...

Examples of Unit Identifications on Vehicles

Left	*Right*	*Unit*
1A - X	HQ - 4	First U.S. Army, Hq & Hq Co., 4th vehicle
VII - M	X - 9	VII Corps, Med Detachment., 9th veh.
25 - 1/27	C - 3	25th Inf. Div, 1st Bn, 27th Inf, Co C, 3rd vehicle
4 - 2R8	A - 6	4th Div, 2nd Recon Squadron of 8th Cav, Troop A, 6th vehicle
7A - 531T	TMP - 12	7th U.A. Army, 531st Trans Truck Co, Trans Motor Pool, 12th vehicle
82ABN - 376FA	B - 2	82nd Airborne Div, 376th Field Artillery Bn, Battery B, 2nd vehicle
XVIIIABN - 313MI	HQ - 2	18th Abn Corps, 313th Mil Intel Bn, Hq & Hq Co, veh 2

Photos (right column):
Top: Markings on this M37 belonging to John Sobotka of Hopatkong, NJ are applied correctly, but place it in the fictitious 50th Armored Div, 5th Armored Bn of the 102nd Infantry—or something like that.

The stenciled "M37" and "RECON" on the bumpers of Jeff Kiefer's M37B1 label it as an imposter.

This gloss-painted M37 seen at a number of UK shows has completely incorrect markings, type font, and more. But I hear it runs like a champ!

John LaBusier's camo-painted M37 looks nice even though it is the wrong camo pattern. On a camo painted vehicle, unit markings should be in flat (lusterless) black.

HOW-TO...

Applying Plastic to a Classic

by Jim Richardson

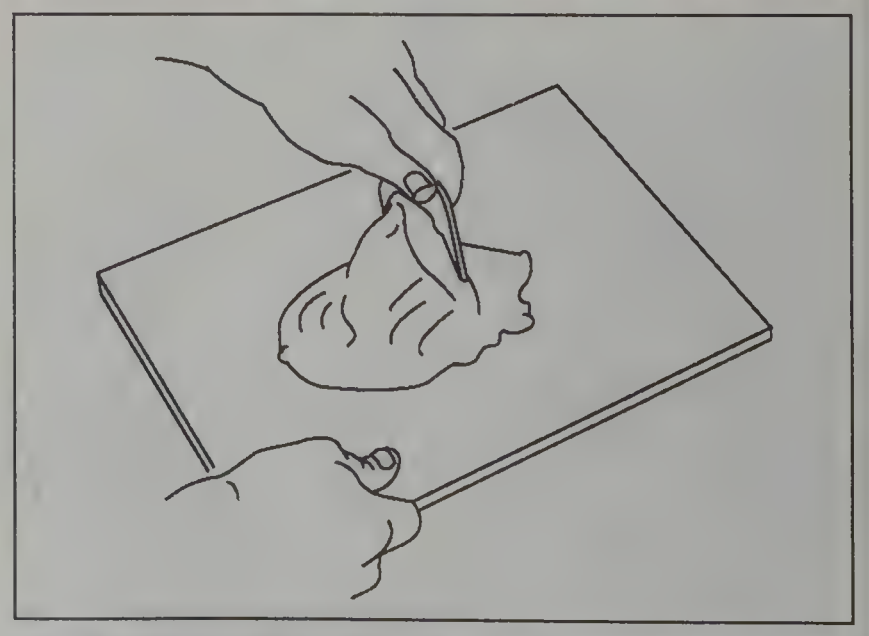
Things You'll Need

- ✔ Professional quality plastic filler and catalyst
- ✔ Plastic spreaders
- ✔ Metal or plastic mixing tray (Never use cardboard; it will absorb critical chemicals and weaken the filler.)
- ✔ Cheese grater shaping file
- ✔ #80, #220, #360 grit, open coat, dry sandpaper
- ✔ Sanding boards
- ✔ Metal prep such as Prep-sol or Pre Kleeno
- ✔ Red oxide enamel primer
- ✔ Lacquer thinner (1 gallon) for washing up.
- ✔ Disposable face mask for dust and particulate matter

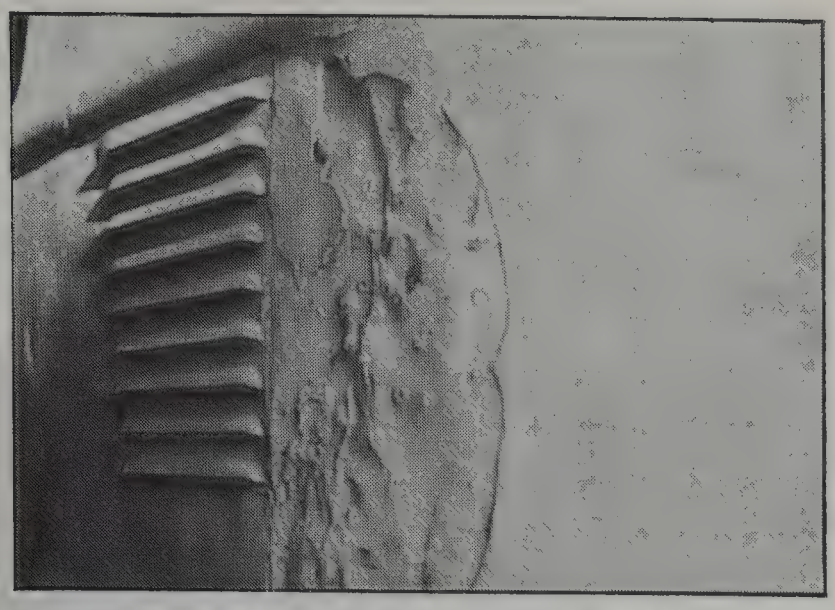
There are purists in the restoration hobby, as well as pros in the profession, who would cringe at the thought of using plastic filler (often referred to by one of the brand names, Bondo) to finish a collector vehicle for painting. They would point out that lead is all that was ever used before the mid-fifties and that it is more flexible and more durable than plastic filler. And they would be right on all counts. The question is, how durable and flexible does body filler have to be?

Plastic isn't strong enough to successfully fill holes, to patch along sharp edges of doors or hoods, or to be used in

Three basic necessities are plastic filler (3M is a good brand) a cheese grater file, and #80, #220, and #360 grit dry sandpaper.



Top: Massage the tube of catalyst with your thumbs to help activate it. Center: Stir the filler completely before adding catalyst. Bottom: Mix filler until it has a uniform color and no streaks.



Body filler works so well that amateurs often abuse it, sometimes grotesquely.

places that endure a lot of flexing. If you are going off-road a lot with your military vehicle, you will want to use filler sparingly and never in areas that are subject bending and torquing. But anywhere else—assuming you use only a thin coat and that it is protected from moisture—filler will work very well indeed. In fact, plastic fillers work so well that they are routinely abused by amateurs.

Some do outrageous things like applying filler an inch thick over unrepaired dents or filling large, ragged, rusty holes backed with nothing but chicken wire or cardboard. And as if that weren't enough, some of these same people drive around for weeks, leaving their cars out in the elements, before giving the filler a protective coat of paint. No wonder they have problems. Lead won't take that kind of abuse either.

Actually, plastic filler—when properly applied—holds up so well that vehicles restored with it 30 years ago—though driven regularly—still look flawless. It really comes down to this: If you are doing a total restoration on an older vehicle during which the body is stripped to bare metal, you will need to replace all the existing body filler—including what was applied at the factory—whether it be lead or plastic. Both deteriorate over time. And at that point you must decide whether you want to put up with the toxicity, expense, and learning curve involved in mastering lead just to get that last ounce of authenticity (even though you'll be the only one who knows) and that last word in durability for a vehiclethat will likely never be treated roughly again.

It's a matter of preference. Lead takes a bit of practice, but you can do it if you try. On the other hand, if you decide—as have many pros—that plastic filler is suitable for your needs, read on. The application technique is quite easy to master, involves no torches that can warp precious panels, and produces no toxic fumes or dust—though it is not a good idea to inhale the particles produced by sanding filler.

12 Do's and Don'ts For Using Plastic Filler

- Do buy fresh, high quality, plastic filler from an automotive paint supply store.
- Do follow the mixing instructions exactly.
- Do apply the filler only over clean, rust-free, metal.
- Do apply plastic filler no more than 1/8" thick at its thickest point.
- Do cover your work with waterproof primer as soon as it has cured.
- Do *weld* holes closed, rather than attempting to patch them with filler.
- Don't apply filler over old paint.
- Don't attempt to patch rust with plastic filler.
- Don't apply filler under cold or damp conditions.
- Don't allow dirt, grit, or contamination to get into your filler.
- Don't allow filler to harden on tools.
- Don't allow filled panels to get wet before painting.

People have been known to use plastic filler even over rust and to fill holes. Don't do it. The job won't last.

Metal Finish It

Neither Bondo nor lead was ever intended to fill deep dents. The best body and fender pros use either filler only to smooth minor imperfections. If possible, they tap out, shrink, and file dents to their original shapes. That is why you will want to polish your skills in metal finishing before attacking your classic.

All of the paint, rust, and any old filler must be removed before a repair can be made. A high-speed grinder shortens this process, but don't get carried away and remove too much metal.

Use an open cheese grater file to shape your work after it hardens to the consistency of Parmesan cheese.

The less proficient you are as a panel beater, the more you will need to resort to filler of some kind. And if—like most of us—you are a hobbyist working at home, there is no question that you will have to use a little filler in places unless your resto project needs very little work or you are exceptionally talented.

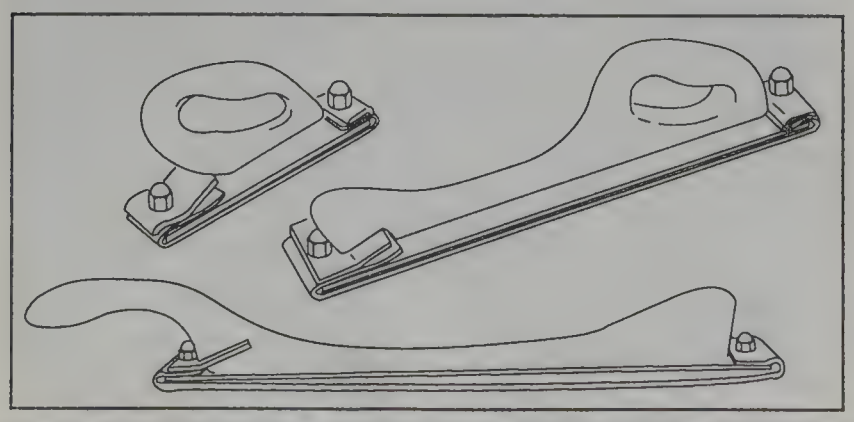
Get It Clean

When you have a dent worked out to the point where you need only a thin film of filler to make it right, you are ready to use filler for its intended purpose. One mistake beginners often make is to over-work dents in an effort to metal finish like the big boys. Don't do it. A little, properly applied filler is not a problem, and is far better than ruining a panel by beating it until it is so thin, hard, and oil-canned that it can't be saved.

Before you open the can of filler, sand or strip any paint and rust off of the area to which you will be applying it. Apply plastic only to perfectly clean, bright, metal. Wipe the surface down with a good metal prep solution such as DuPont's Pre-Kleeno. This will etch the metal to give it "tooth" so the filler will adhere properly.

Mix It

Before you mix up a batch of filler, massage the tube of catalyst with your fingers to mix it and warm it. Also, stir the filler thoroughly, because it separates out in the can in storage. Now mix up only as much filler as you can easily spread in about 10 minutes. That is usually about a 1½" line of catalyst to a golf ball sized gob of filler, but follow the mixing instructions on the product you purchased exactly. Filler sets up to the consistency of Parmesan cheese in about 20 minutes so any more filler than you can apply in about 10 minutes will go to waste.



Use sanding boards on large, flat surfaces so you won't make grooves or ripples in your work.

Don't try over-doing the catalyst or applying heat in an effort to get the material to set up more quickly. Both tricks have adverse effects on durability. Also, don't use less catalyst on a hot day, because you will wind up with a sticky glob of goo that will never harden. Mix filler and catalyst thoroughly so your filler has a consistent color all the way through. Be careful not to trap air bubbles while you are mixing; they will cause problems later when you do your shaping work.

Apply It

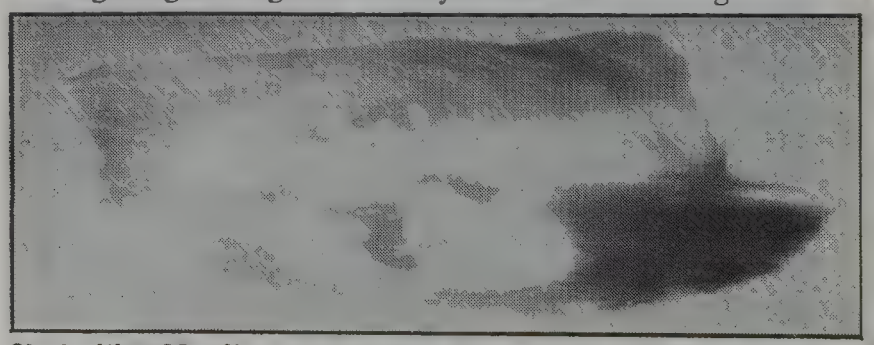
Apply a thin, even, coat of filler about ¼" thick, which is a little thicker than what you want as a finished surface. This will allow for shaping and sanding. Keep your spreaders and mixing palette scrupulously clean, because little bits of grit or hardened filler will ruin your work by making grooves in it as you attempt to spread the filler. Now, while your plastic work is hardening, is a good time to quickly wash your tools in lacquer thinner. If you neglect to do so, you may have to throw your tools away once the filler hardens.

When the filler sets up to the consistency of Parmesan cheese, shape it roughly with an open, cheese grater file made especially for the purpose. Don't forget to don a particle mask at this point. Now switch to #80 grit sandpaper and shape the filler more carefully. Work from the edges in toward the center to feather the filler and prevent low spots. Sand in a criss-cross fashion to avoid making grooves. Wherever possible, use a sanding board.

Often as not, a second or even third application of filler is required to finish the job properly. That is why it is important to follow the mixing instructions as precisely as possible. If you don't, your second batch of filler may be harder or softer than the first one, which will cause problems when you try finish sanding your work. Pros refer to the result as a "fried egg," because poorly mixed filler often shows up as a sort of circle within a circle that looks something like a fried egg on the side of your vehicle after it has been painted.

Go to the #360 grit paper to do your final finishing. Glazing putty can be used to fill tiny pin holes, but don't use it for anything else, as it is not strong enough for big areas. If you are unsure about whether you have your panel exactly the way you want it, shoot on a fine mist of paint in a contrasting color using an aerosol can, then sand it off. High spots will show up immediately, and low spots will continue to be speckled after several sanding strokes. Be sure to fix any imperfections before going to the next step.

When you have everything exactly right, let the filler cure for several hours in a dry, warm place to allow gasses to escape before priming it. Finally, shoot on a little waterproof enamel primer to seal the panel and prevent rust. Later you will want to shoot on primer-surfacer and sand it with the #360 grit again to get rid of any minor surface irregularities.



Start with #80 grit paper to further shape your work. Then go to the #220 and #360 grit. Work in from the edges in to avoid low spots.

Fill Up That Hole, Soldier

by Jim Richardson

All too often users drill holes in the sheet metal of old trucks and military vehicles to install accessories and mount decorative items. Holes seem to be unavoidable in restoration projects, and there is really only one good way to fill them, and that is to weld them up. Packing them with lead or plastic filler is only a temporary solution to the problem, but welding them makes the panel whole again.

Welding holes closed with an old style oxy-acytelene rig takes skill and a delicate touch because of the tremendous heat involved. If you are not well practiced in the art of gas welding, I don't recommend that you learn on the sheet metal of your restoration project. Instead, buy, borrow, or rent a MIG welder. Nowadays, no body shop is without one because they allow you to weld thin sheet metal without warping, oil canning, or shrinking, and they are easy to use.

Small rigs that operate on 110-volt household current are priced at about $400, but prices can exceed $3,000 for the professional models that operate on 220-volt current. Of course, the argon shielding gas bottle is extra, but it can be rented.

I use a Lincoln MIG PAK 10 and have had good results. Of course, if you are working on thick armor plating, you will need a heavier machine, but for the usual range of body metal, the lighter welders are more than adequate.

Practice with the welder before attacking your vehicle. Even a MIG welder, though simple to master, requires a couple of hours of practice to get the angle of the nozzle and the wire feed rate right. Practice lap welds first, then try butt welds with metal scraps about 1/32" apart.

For bigger holes like this one made to mount huge signal lights on the fenders of this pickup, first mark up a piece of sheet metal held from behind to make a patch or trace the hole on a sheet of paper.

Small holes can be welded in by holding a copper paddle from behind and welding the hole shut from the front, but large holes must be plugged. For these larger holes, I strongly recommend a butt-welded flush plug rather than a lap-welded layered patch. If you lap weld a patch in from behind, you will be making an overlap that can retain moisture and rust, and once a lapped patch is welded into place, there is no way

For small holes, just hold a copper paddle behind the hole and weld it up, working in circles until the hole is closed.

Cut it out, then check your tolerances and fine-tune the patch so it fits with a 1/32" gap.

Clamp the patch in place using welder's vise grips or clecos.

to apply a protective coating to the inner, overlapping surfaces. Also, lap welds can cause seams and ripples to appear as a panel flexes in use.

The reason for allowing a 1/32" gap all around on a butt weld is that the metal expands as it heats, so if you cut it to be flush when it is cold, it will expand and buckle or overlap when it heats up.

For each hole that you want to fill, make a pattern by placing a piece of paper over the hole and rubbing around the periphery of the hole with a pencil. After that, cut out the paper disk, place it on your sheet metal, and fog it with a little aerosol paint. Pick up the paper, and there's your pattern on the metal. Cut out your plug with tin snips.

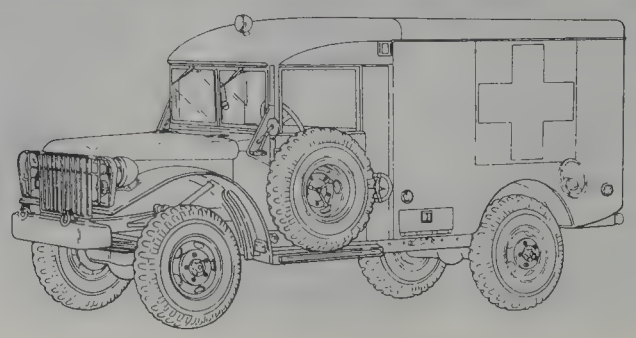
Be sure to make your plugs out of sheet metal that is the same gauge and carbon content as the metal to which it will be attached. An old panel from another vehicle of the same type is perfect for patches, or you can buy sheet steel from local sources in most metropolitan areas (look up "Metal Stamping" or "Sheet Metal Work" in the yellow pages).

Tack the patch in place, then fix any warping using a picking hammer and dolly.

Weld it up, working back and forth across the patch to control heat.

Grind it flat with a surface grinder, then give it a coat of self-etching primer (or metal prep with rust preventative) to prevent rust.

Source for MIG Welders: TiP Tools & Equipment, Dept. MV, P.O. Box 649, Canfield, OH 44406, 800-321-9260.



Let Us Spray

by Jim Richardson

As with many other aspects of restoration, shooting paint requires a little precision and a lot of patience, but you can do it if you try. And with the new high velocity, low pressure (HVLP) systems, it's not as messy as it used to be.

Safety First

Before you even start, make sure you are aware of the hazards of spray painting. Most paints are toxic, and many are volatile, so it can cost you your health and possibly your life if you get careless about breathing fumes or shooting paint around sources of combustion.

Wear at least a long-sleeved shirt and a cap while painting. Full coveralls are even better. Secondly, if you sport a beard or goatee, rub a little Vaseline around the edge of your painting mask to help it seal better so you won't be overcome with fumes. And be sure to wear a top quality, professional painting mask with charcoal filters, if not a fresh-air hood.

More important, if you paint indoors, work in a well-ventilated place that has fans with special, flash-proof motors. The motors on ordinary fans give off sparks in operation, and because a spray gun works much like a carburetor as it atomizes volatile fluids, the combination creates a potentially explosive situation.

You will need adequate light, so install a few fluorescent fixtures (you can buy them very inexpensively at most hardware and discount stores) on the ceiling and on the walls of your shop to help you see. And make sure have powerful, safe, filtered fans to clear the air.

Make sure also that your work area is spotlessly clean of dust and contaminates, and never work where there is a water heater or other device with a pilot light that could ignite fumes.

Spray painting in the field yields less-than-excellent results.

And if you are an amateur, stay away from the horribly toxic two-stage paints like Imron too. (If you really want to shoot Imron, get a fresh-air hood and use it religiously, because the stuff is really deadly.)

Equipment

Until recently, the standard rig most pros used for spray painting was, at minimum, a 2 hp compressor, a couple of water traps, 50 feet of hose, and a couple of good spray guns like those manufactured by Binks and De Vilbiss. At today's prices, this equipment could set you back $800 to $1000. And yes, these items are still available and will do a marvelous job. The problem is, these old-style guns actually put less than 50 percent of the paint on the vehicle. The rest winds up in the air--and on you. Thankfully, there is now a better way.

A few years ago, manufacturers were looking for ways to cut down on the toxic pollutants pumped into the atmosphere by spray painting. What they came up with was the high volume, low pressure, or HVLP, system. It consists of a three-stage electric turbine that looks like a square canister vacuum cleaner with a paper air filter on its side, plus 30 feet of clear 1" diameter hose, and an almost conventional-looking spray gun. (Its spray orifices are a little bigger, and the gun is somewhat lighter than a conventional gun.)

There is no compressor involved, and there are no water traps. There is no need for either of them. I use a model called the AccuSpray that sells at this writing for $895. I like it because, once you get used to it, the rig does as good a job as the old-style equipment, and it meets the newest VOC, or Volatile Organic Compounds, regulations, which is important to me because in California where I live, HVLP systems are the only legal systems. But most of all I like the fact that an HVLP system takes a third less of that expensive paint to do a vehicle.

Of course, just because your painting rig meets VOC regulations does not mean that it is legal to paint your vehicle in your garage or driveway. Be sure to check with local authorities before setting up a home spray booth or shooting lots of paint outdoors. If you are not allowed to paint vehicles in your area, check with local junior colleges to see if you can use their auto shop spray booth, or better yet, enroll in a night class. Another possibility is to check with a local body shop to see if you can rent their spray booth on the weekends.

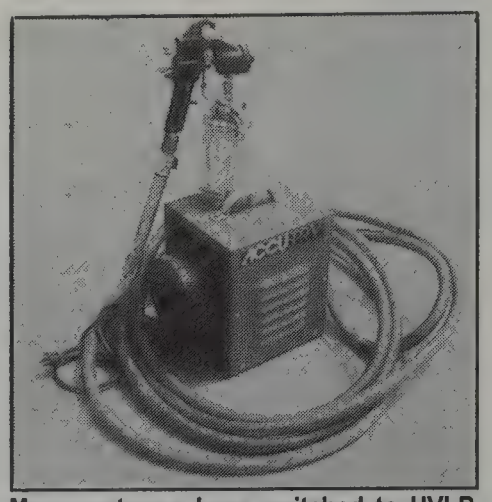
Mixing

If you use standard automotive paints, you will have to add dulling agents to your olive drab or camouflage colors to match the original semi-gloss or flat paint. Keep in mind that too much of the dulling agent will make your paint quite porous, allowing water to penetrate, and allowing the surface to scuff quite easily.

Because of the scuffing problem, it is also a good idea to have the paint supplier mix up several aerosol cans of the same color using the correct amount of flattener so you can touch things up periodically. Also, if you are going to use a flat paint, be sure to apply a two-stage epoxy primer under it to prevent corrosion. Most primers are not waterproof, so choose carefully.

Combine paint and reducer carefully to the exact measurements called for in the instructions. (To avoid liability problems, some manufacturers no longer put mixing instructions on paint cans, but will send you a flyer that includes them if you call or write for one.) Stir the paint thoroughly, then strain it through one of the disposable paint strainers most automotive paint stores provide as a courtesy.

The best way to learn how to spray paint is to practice. Nobody does it right the first time. Get some old tin cans, lawn furniture, bad body panels, or discarded barbecue hoods and practice shooting rounded surfaces before shooting your vehicle's carefully prepared components.

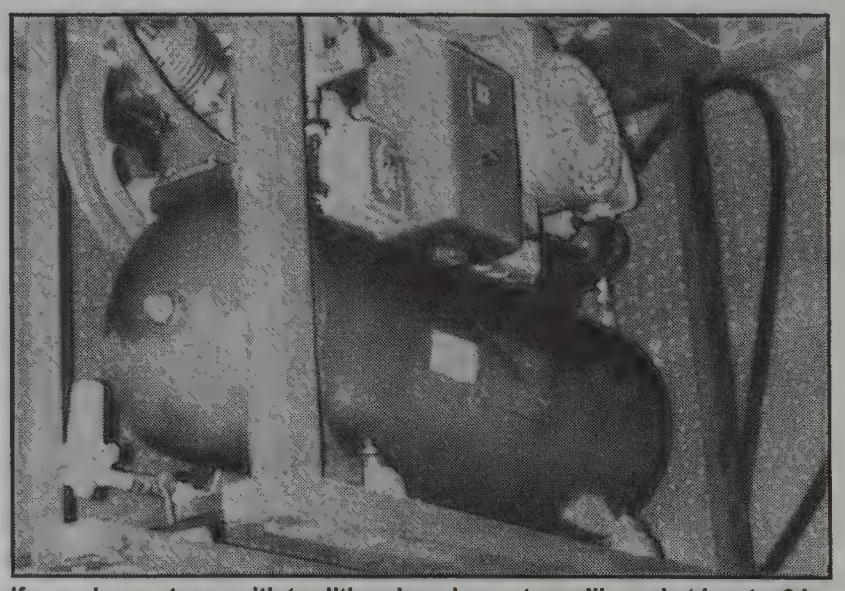


Many restorers have switched to HVLP (high volume, low pressure) spray equipment. This is the complete rig. There are no water traps or big compressors required.

The spray gun should be held about 9" away from your work (If you spread your fingers, the span between the tip of your thumb and the tip of your pinkie is about 9" inches.), and the nozzle should be perpendicular to the object you are painting at all times. If you angle the gun toward the surface, more paint will build on the near side of the circle of spray than on the far one, causing runs.

Set the pressure and volume with the controls on the back of the spray gun handle according to the instructions that come with the paint and those that came with the equipment.

On the left is a high quality Binks spray gun, the mainstay of every auto painter's spray equipment for 50 years. In the center is a new HVLP gun. On the right is an inexpensive foreign-made spray gun. In the past, many pros shot primer with one of these, then used their expensive Binks or De Vilbiss guns to shoot color coats.

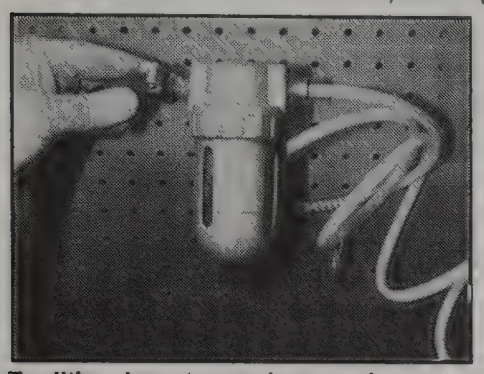


If you choose to go with traditional equipment, you'll need at least a 2 hp horsepower compressor. This one is mounted up high so water condensed out of the compressed air can be drained off easily.

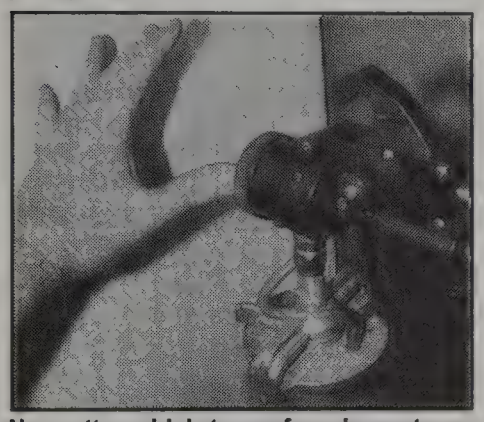
Different types of paint require different pressure and volume settings. While you are painting, don't let up on the trigger between passes. Doing so just increases the chances of a clogged gun. Overlap your passes along a panel by at least a third to insure even coverage.

Shooting flat finishes can be a challenge. For one thing, you need to overlap your passes a little more with flat paint than with shiny. In fact, overlapping by half is a prudent way to do it. Also, you will want to shoot your coats at right angles to each other. For example, if you were shooting the hood of your jeep, you would apply a coat front-to-back, then the second coat side to side. Then for the final coat, you would go front-to-back again assuming the standard, three coats of enamel.

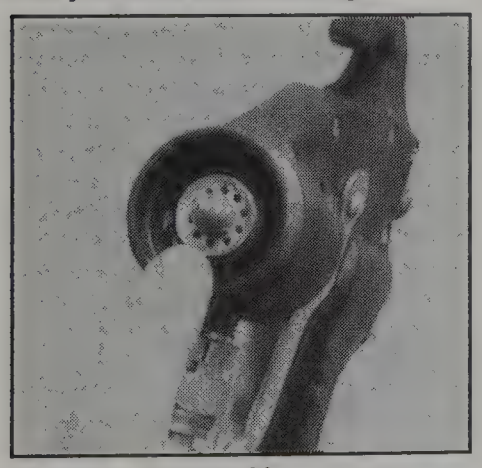
Another little trick you can use when shooting enamel is to first shoot on a fine mist, let it get tacky, then shoot on a nice, wet coat. That way you avoid sags and runs. The object–and the challenge–of spray painting is to shoot on as wet a coat of paint as possible without causing sags. When they do form, and they will occasionally, let them alone until the paint dries. Then sand them out. Trying to wipe them off with a rag will just make a bigger mess.



Traditional systems also require water traps (two are preferable) in the air lines to your gun to avoid shooting water into your paint.



No matter which type of equipment you go with, you will want to hold the spray gun about 9", or one hand-width, away from your work while shooting.

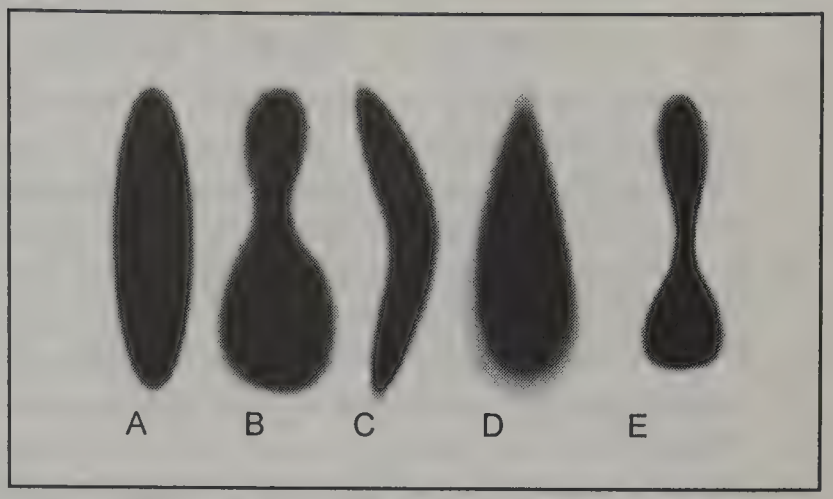


Be sure to disassemble your spray gun and clean all of its parts thoroughly in lacquer thinner after each use. Clean the spray nozzle with a toothpick soaked in lacquer thinner.

When you finish shooting, take your gun completely apart and clean it thoroughly with lacquer thinner. Use lacquer-soaked pipe cleaners to get into the pickup tubing, and use toothpicks to clean spray and vent orifices. Never use wire to clean nozzles or orifices because their surfaces are carefully machined and can be ruined by such harsh treatment.

Cleanup is a very important step, because most of the problems with sputtering spray guns can be traced to sloppy maintenance, such as leaving little bits of dried paint in the wrong places. Finally, put a little Vaseline on the volume adjuster needle shaft where it goes into the packing gland to help it seal before reassembly.

Above all, don't shoot first and ask questions later. Patience is an important virtue for a beginning painter. If you are unsure of anything, call the paint store where you purchased the materials or call the manufacturer and clear up your confusion. Talk to other hobbyists who have some experience or pick the brains of the employees at the local automotive paint supply. Good luck.



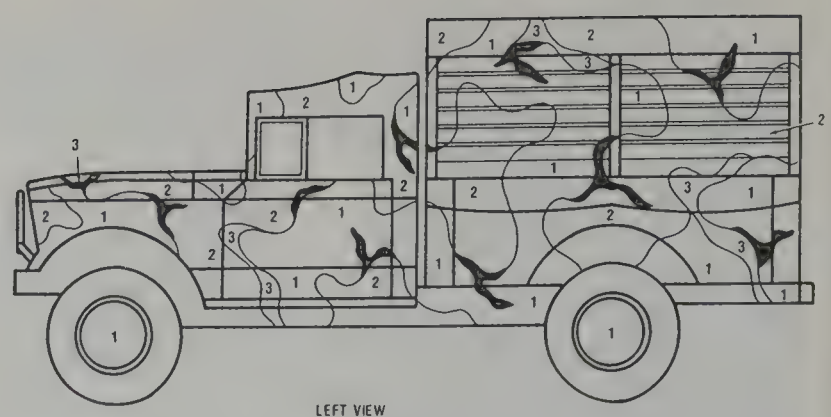
Spray pattern problems: A - The way your spray pattern should look. B - This indicates atomizing pressure is too low. Increase pressure at gun, or with old style systems, possibly at the compressor. C - If your spray pattern is skewed to the right or left it is because a wing port on the air cap is clogged. D - If your pattern is big at the top or bottom, it is because you have a partial clog in the spray nozzle. E - A spray pattern that is squeezed in the middle means the atomizing pressure is too high (a problem often experienced with old-style equipment.)

7 Tips for Painting with Aerosol Cans

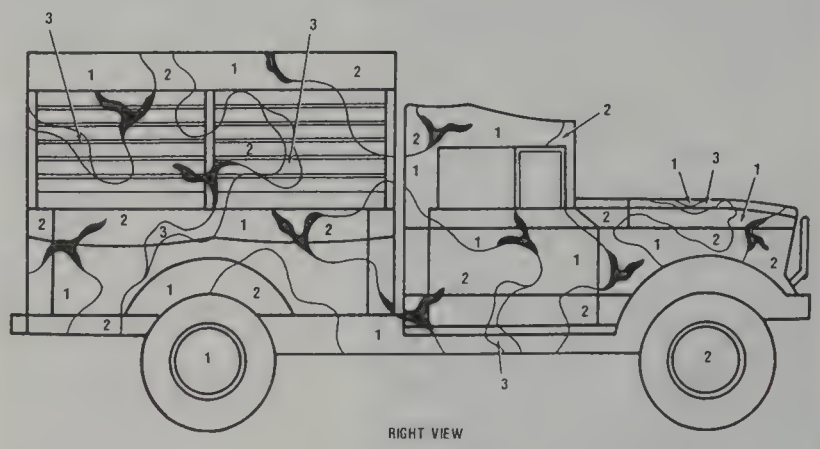
1. Pay a little more and buy quality paint. Also, pick up a few extra spray tips while you are at the paint store.
2. Always shake the can thoroughly before shooting paint. By thoroughly I mean for two full minutes. Now that may sound excessive, but many paints have heavy pigments in them that settle to the bottom of the can in storage. If you don't shake the can enough, the spray tip will clog in no time.
3. Take the same safety precautions with aerosols as you do with a spray rig. Wear a charcoal mask, work in a ventilated area, and don't work near any potential source of combustion.
4. Just as with a spray rig, if you are shooting enamel, shoot on a light mist tack coat and let it get sticky before shooting on a heavy coat.
5. To prevent the tip from clogging and sputtering, don't let up on the nozzle between passes. Also, when a can is running out of paint, don't try to shoot every last drop. You'll get splatters and runs if you do.
6. When you are finished spraying, hold the can upside down and press down on the nozzle until the spray becomes clear. This will blow any existing paint out of the tip and prevent it from clogging. That way you will be able to use the rest of the paint later.
7. Wash out the spray tip with lacquer thinner for maximum protection from clogs before storing the spray can.

Dos and Don'ts of Spray Painting

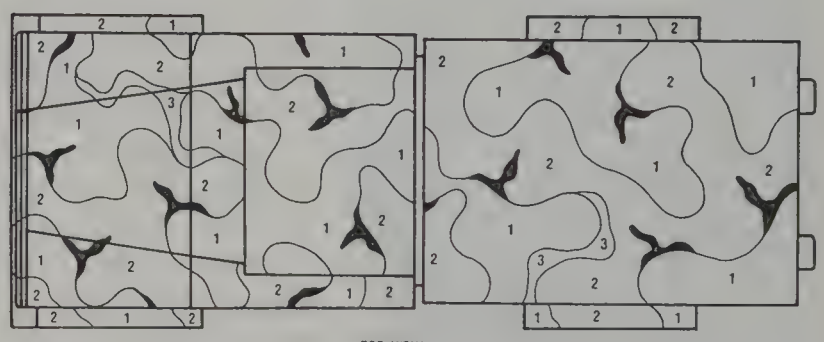
- **Do** clean the surface thoroughly with an industrial-strength cleaner/degreaser before shooting paint
- **Do** use compatible primers, sealers, and paint, preferably from the same manufacturer and paint system.
- **Do** shoot on a thin fog, or tack coat, and let it get sticky before shooting on color coats of enamel.
- **Do** follow the mixing instructions for your paint exactly.
- **Do** change the charcoal filters in your paint mask frequently.
- **Don't** ever try to paint without proper ventilation and a good charcoal filtering mask or fresh air pack as required by the paint system.
- **Don't** paint your vehicle on a rainy, cold, or extremely humid day.
- **Don't** try to wipe up runs. Let them dry; then sand them out.
- **Don't** let your spray gun sit before cleaning it after painting. (Many paints set up, or "dry" within a half hour and are hard to remove after that.)
- **Don't** rush. Let each coat dry thoroughly so all of the solvents and gasses escape before shooting on the next coat.



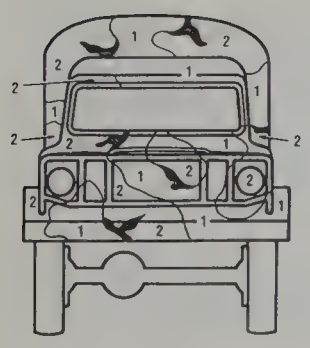
LEFT VIEW



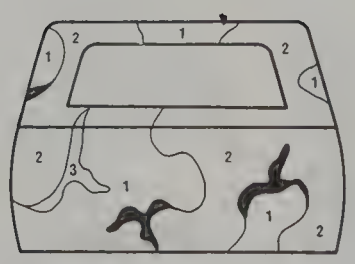
RIGHT VIEW



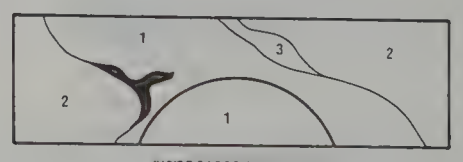
TOP VIEW



FRONT VIEW

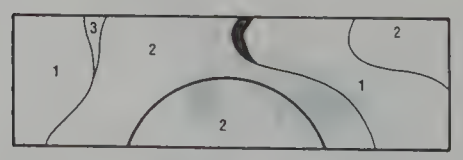


INSIDE CARGO AREA, FRONT; AND CAB REAR



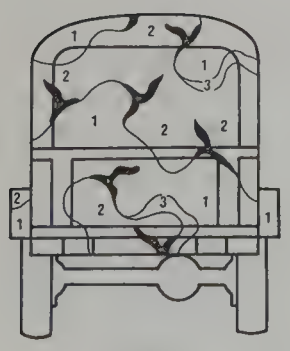
INSIDE CARGO AREA, RIGHT

FRONT

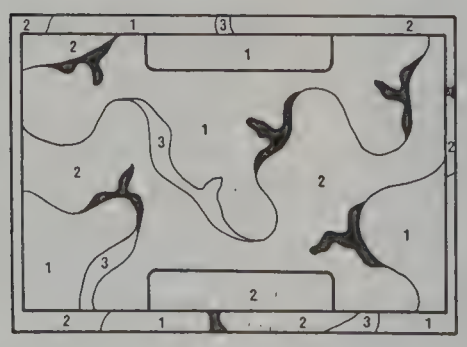


INSIDE CARGO AREA, LEFT

FRONT

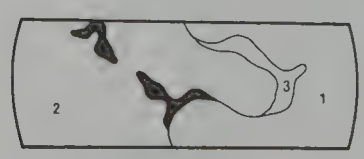


REAR VIEW



CARGO AREA

FRONT



INSIDE CARGO AREA, REAR

4-color camouflage painting pattern for an M37 is the same as for an M715. This is the pattern from Dept. of the Army Technical Bulletin TB 43-0209 dated October 1976. For the U.S. and Europe, color 1 is forest green, color 3 is sand, and color 4 is black. For winter and northern climates, color 2 is field drab; for summer and southern climates, color 2 is light green; for temperate snow with trees and shrubs, color 2 is white (or very light green).

SECTION V

The 40 pages of this section are exploded views of various engine, drive train, electrical, fuel system, and body assemblies of the M37. These illustrations are reproduced from the Dept. of the Army Supply Manual, ORD 9 SNL G-741 of January 1954. The illustrations in this book have been reduced to about 75% to 85% of their original size. The key to all of the illustrations lists the parts by name, federal stock number, and, in some cases, standard government grouping. The numbers, in general, will not do you much good except that some vendors such as Memphis Equipment do, in fact, reference parts by FSN. The complete 507-page ORD 9 manual with full-size illustrations and complete part descriptions is available from Portrayal Press for $59 + $5 s&h (P.O. Box 1190, Andover, NJ 07821) and an abbreviated 40-page manual is available from Memphis Equipment for $10 postpaid (766 So. Third St., Memphis, TN 38106).

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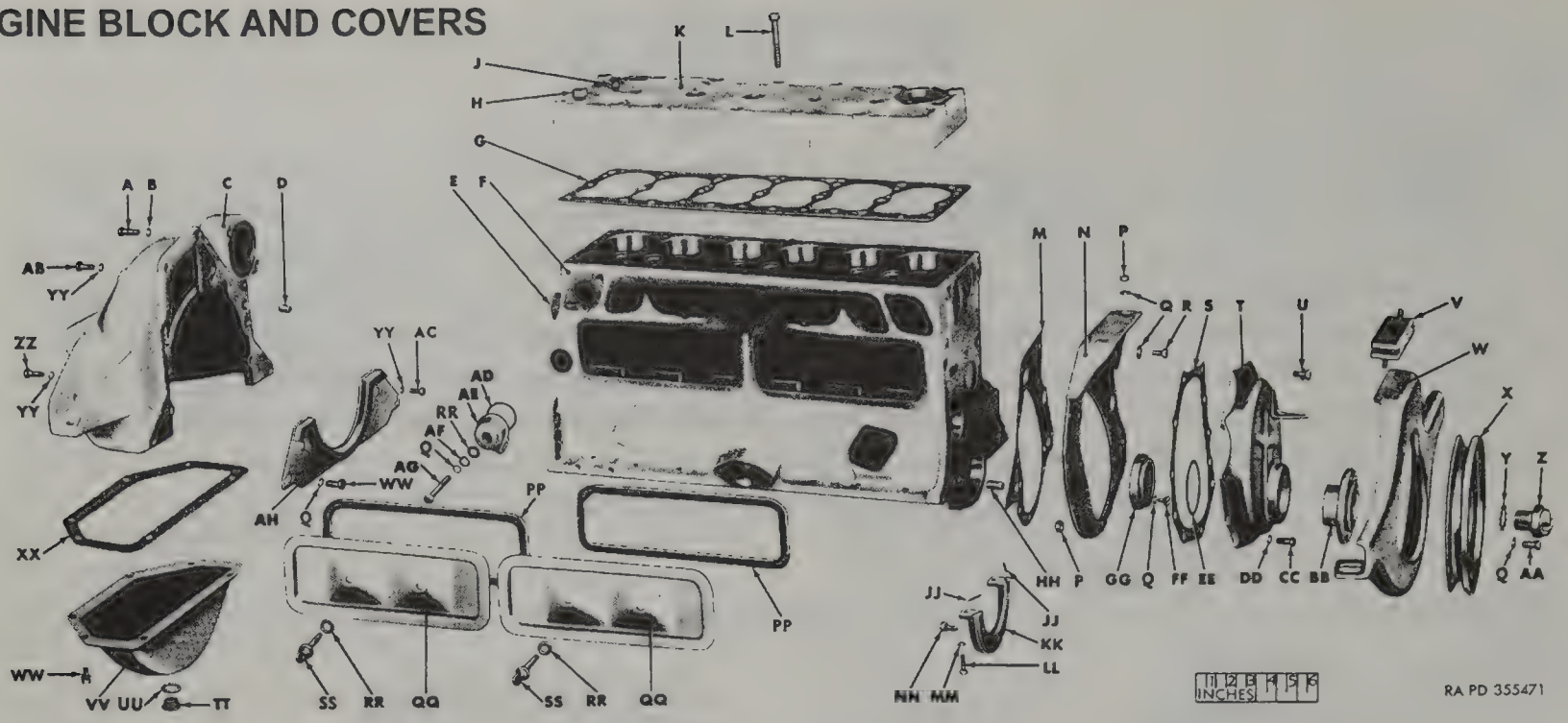
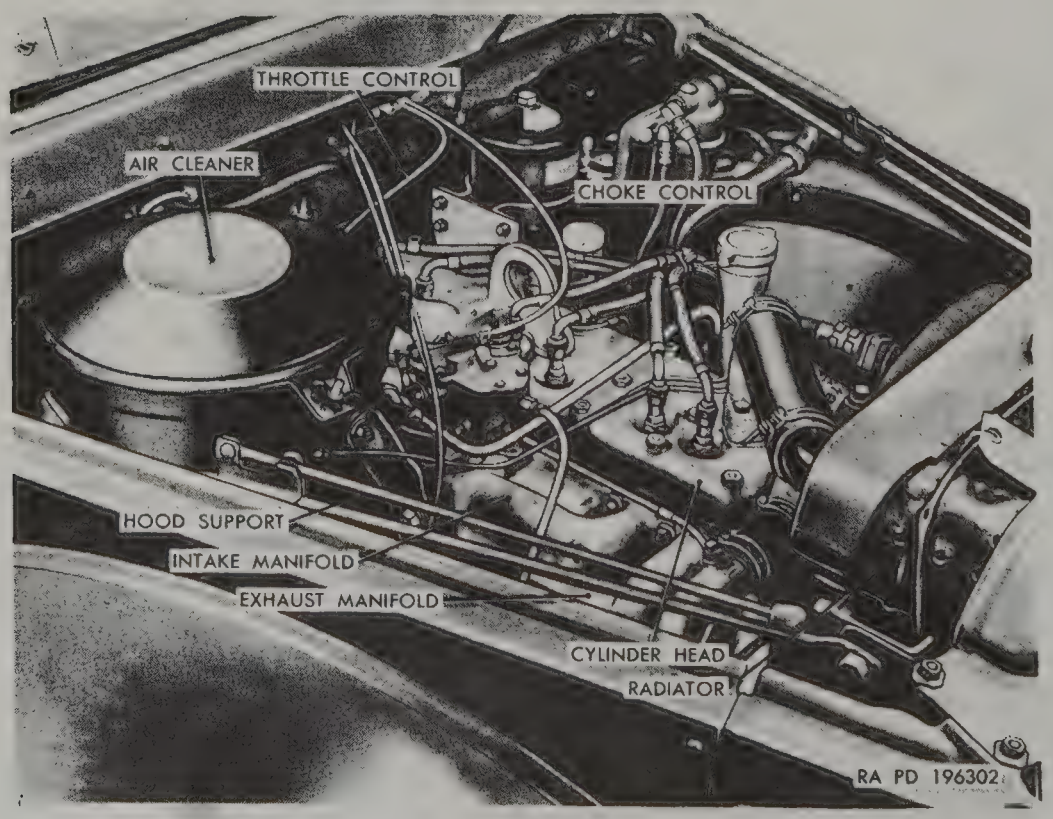
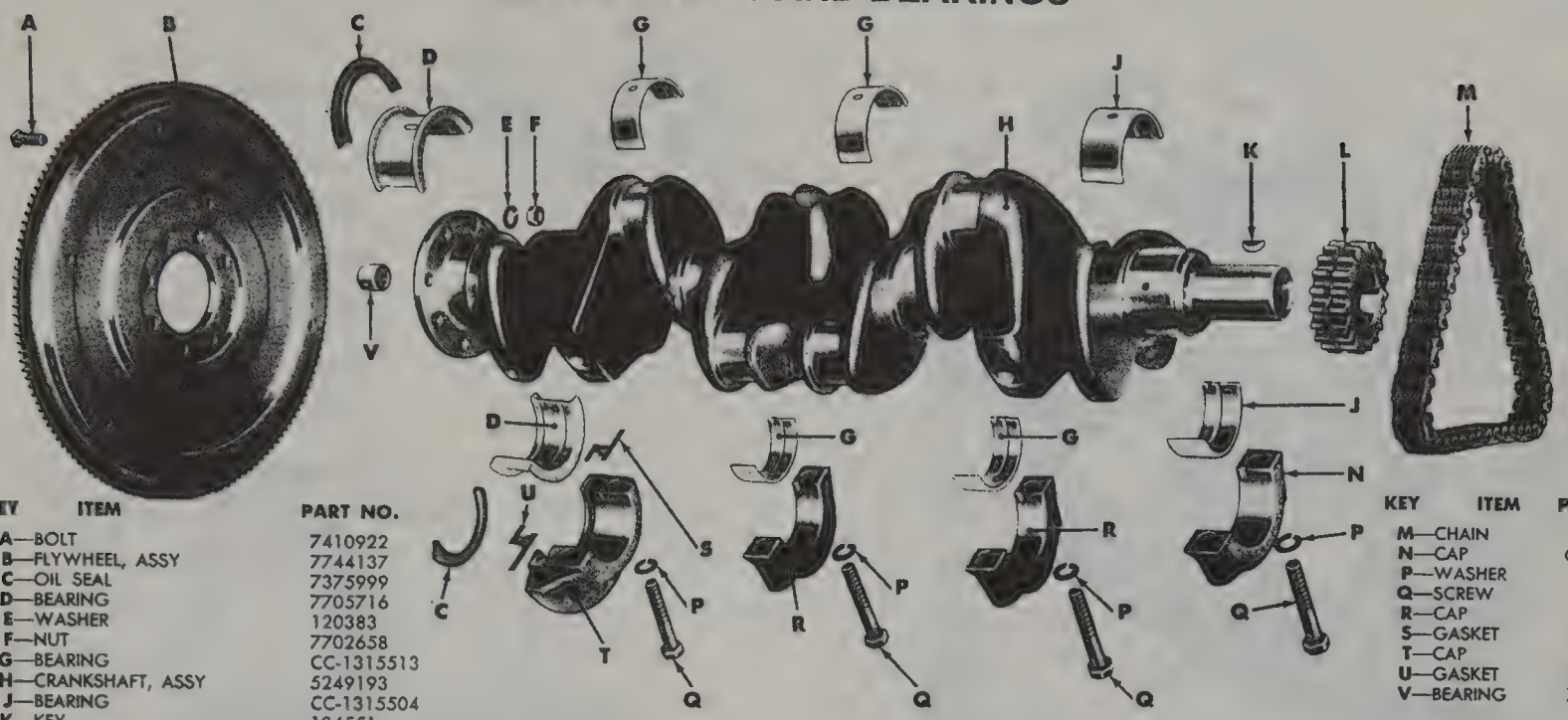
ENGINE BLOCK AND COVERS



Key	Item	Part No.
A	— SCREW	122267
B	— WASHER	120383
C	— HOUSING	7373384
D	— PIN	7373674
E	— PLUG	501569
F	— BLOCK, ASSY	CC–1322330
G	— GASKET	7373653
H	— PLUG	103868
J	— PLUG	CC–1123774
K	— HEAD, ASSY	7374761
L	— SCREW	7702732
M	— GASKET	7351247
N	— PLATE	7351244
P	— NUT	120368
Q	— WASHER	120214
R	— SCREW	133837
S	— GASKET	7373645
T	— COVER, ASSY	7373642
U	— SCREW. ASSY	7373643
V	— CUSHION	7351297
W	— PLATE	7373657
X	— PULLEY	7705719
Y	— WASHER	7702463
Z	— JAW	7702761
AA	— SCREW	123473
BB	— HUB	7705718
CC	— SCREW	120741
DD	— WASHER	7373644
EE	— GASKET	CC–1088603
FF	— SCREW	122007
GG	— SEAL	MMB–61865
HH	— PIN	7702600
JJ	— SEAL	7373672
KK	— PLATE	7005409
LL	— SCREW	132268
MM	— WASHER	120380
NN	— SCREW, ASSY	423393
PP	— GASKET	CC–871934
QQ	— COVER	7410874
RR	— GASKET	7351040
SS	— SCREW	7410876
TT	— PLUG	7374954
	PLUG	8327903
UU	— GASKET	105456
VV	— PAN	7373383
WW	— SCREW	120228
XX	— GASKET	8329974
	GASKET	7373385
YY	— WASHER	120382
ZZ	— SCREW	122145
AB	— SCREW	120918
AC	— SCREW	122104
AD	— GASKET	7702584
AE	— FITTING	7410942
AF	— WASHER	120387
AG	— SCREW	126078
AH	— PLATE, ASSY	7351216
	PLATE, ASSY	8329972



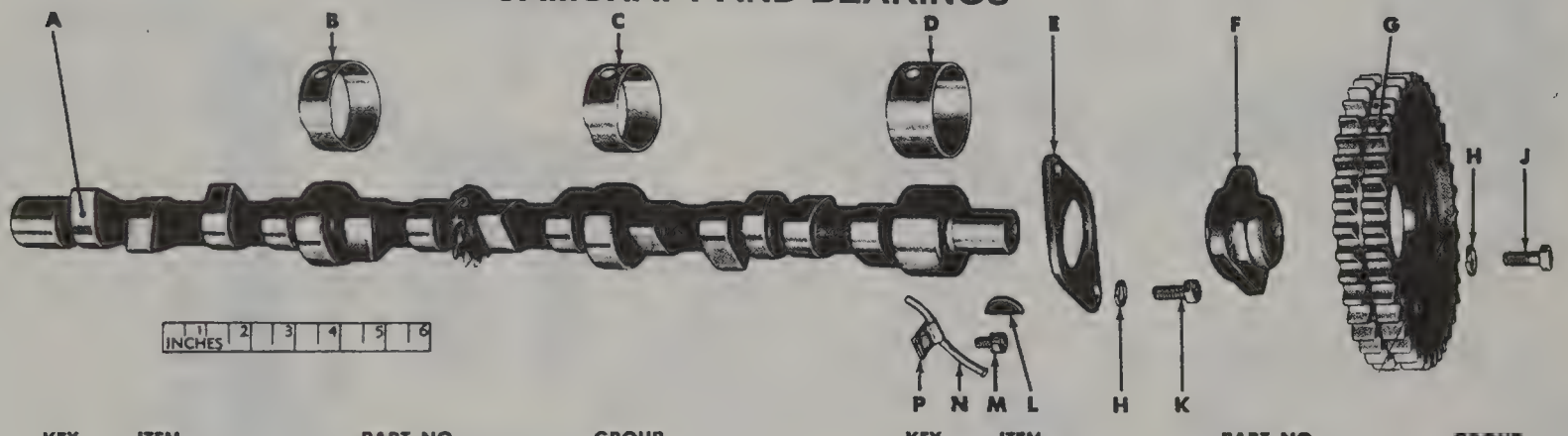
CRANKSHAFT AND BEARINGS



KEY	ITEM	PART NO.
A	BOLT	7410922
B	FLYWHEEL, ASSY	7744137
C	OIL SEAL	7375999
D	BEARING	7705716
E	WASHER	120383
F	NUT	7702658
G	BEARING	CC-1315513
H	CRANKSHAFT, ASSY	5249193
J	BEARING	CC-1315504
K	KEY	134551
L	SPROCKET	7351240

KEY	ITEM	PART NO.
M	CHAIN	7351248
N	CAP	CC-630476
P	WASHER	120384
Q	SCREW	7702669
R	CAP	CC-630477
S	GASKET	8331515
T	CAP	CC-1140975
U	GASKET	8331514
V	BEARING	7372621

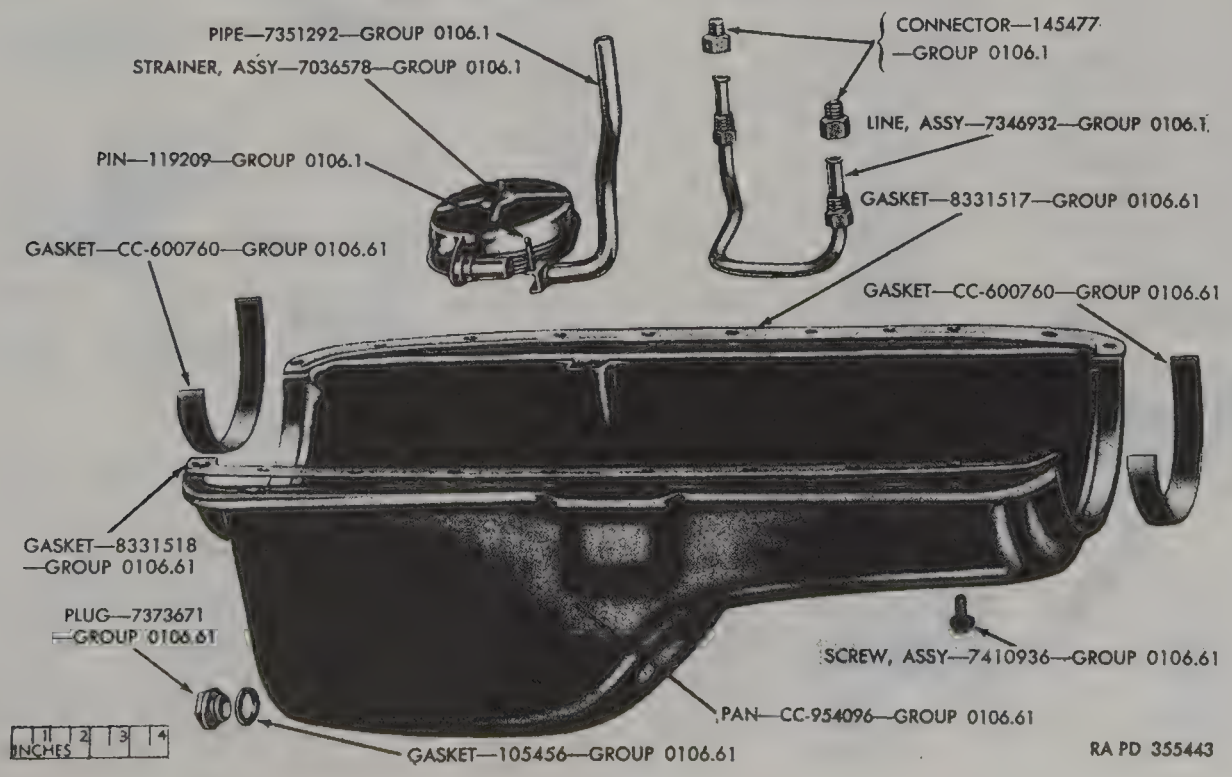
CAMSHAFT AND BEARINGS



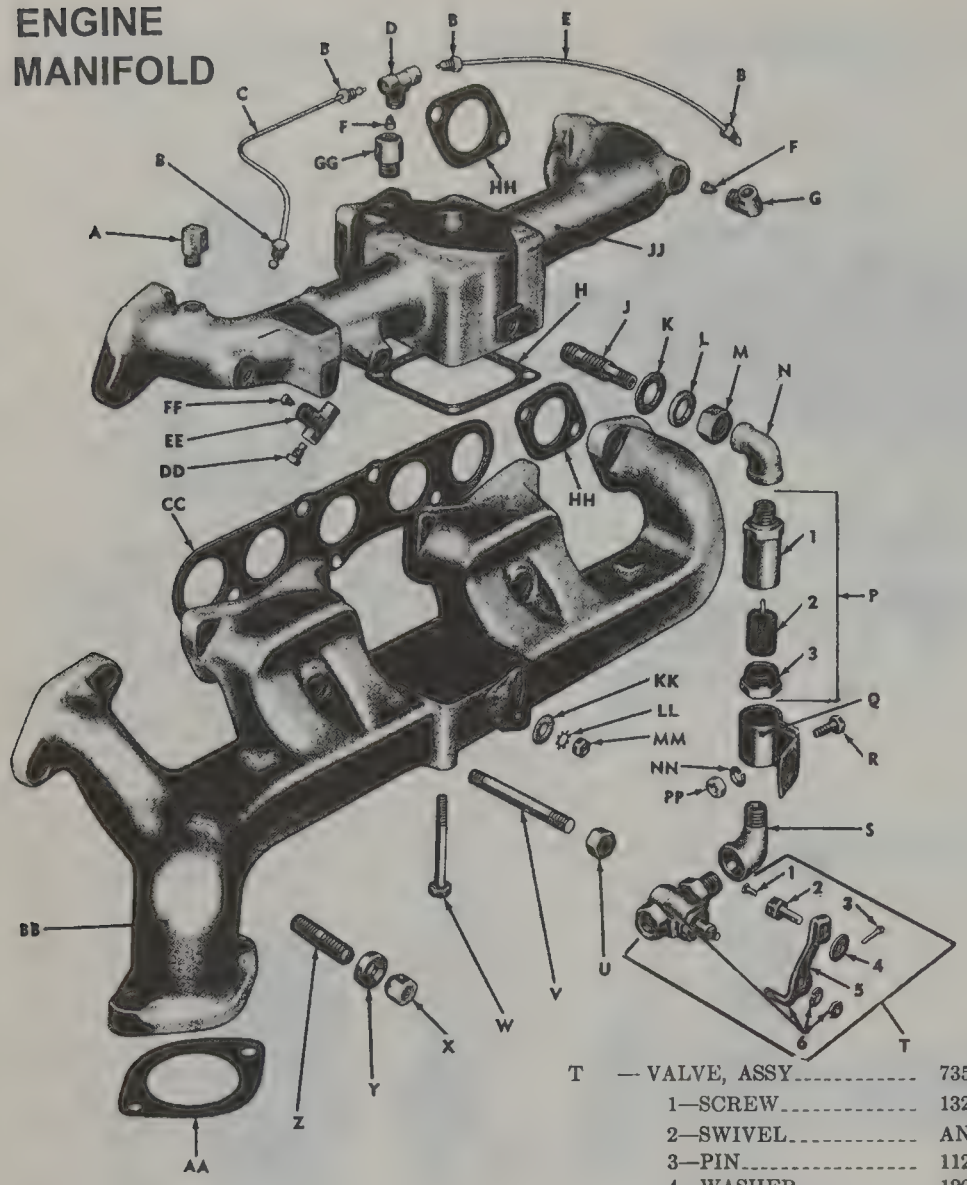
KEY	ITEM	PART NO.	GROUP
A	CAMSHAFT	7373641	0105.3
B	BEARING	8331521	0105.3
C	BEARING	8331513	0105.3
D	BEARING	7702615	0105.3
E	PLATE	7351245	0105.5
F	HUB	7351246	0105.5
G	SPROCKET	7351242	0105.5

KEY	ITEM	PART NO.	GROUP
H	WASHER	120214	0105.5
J	SCREW	7351241	0105.5
K	SCREW	122007	0105.5
L	KEY	120051	0105.5
M	SCREW, ASSY	186410	0106.67
N	NOZZLE	7351291	0106.67
P	CLIP	120520	0106.67

OIL PAN, STRAINER, AND GASKETS

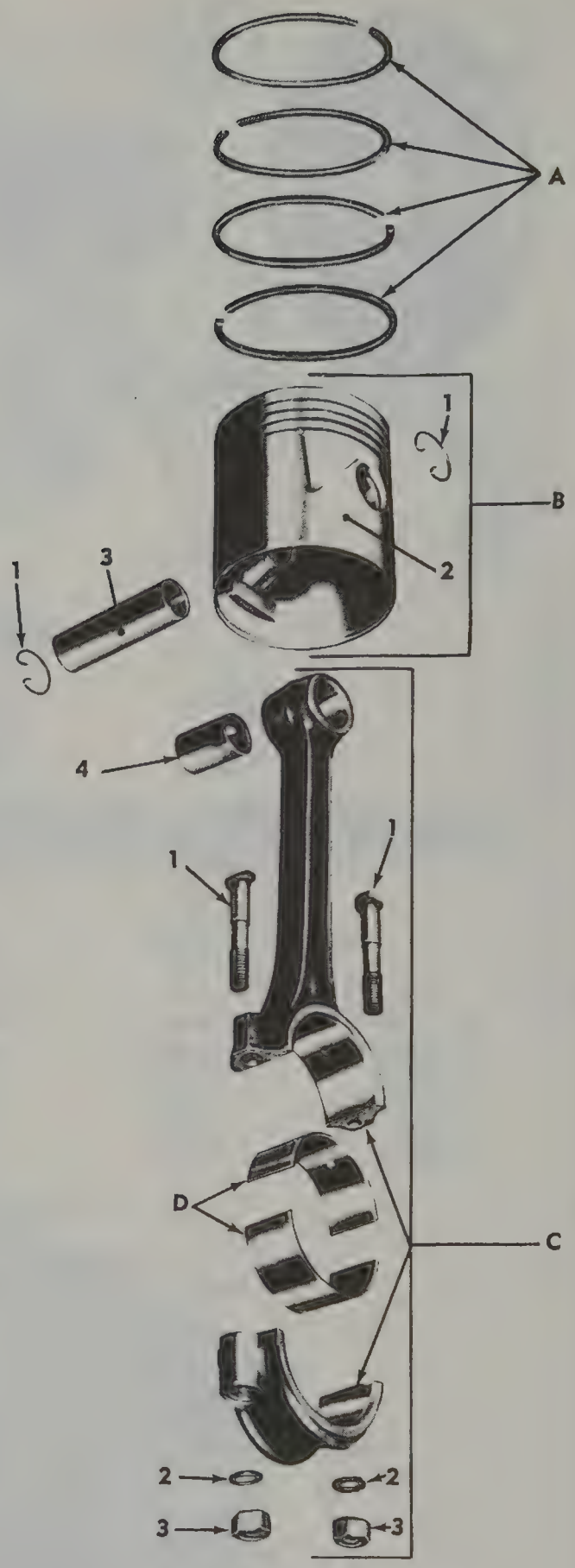


ENGINE MANIFOLD



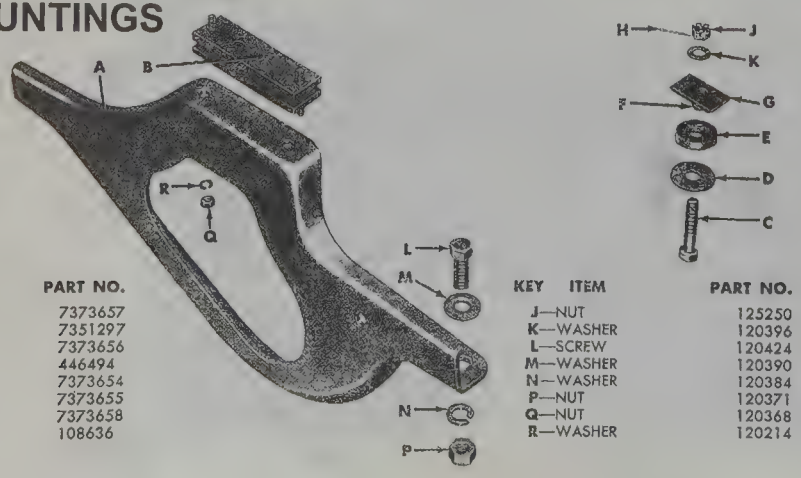
Key	Item	Part No.
A	— ELBOW	137421
B	— NUT	CC–119342
C	— TUBE	CC–1391450
D	— TEE	CC–928515
E	— TUBE	CC–1391451
F	— SPRAY, ASSY	DV–PR3–37
G	— ELBOW	DV–PR20–41
H	— GASKET	7410867
J	— NIPPLE	CC–1274903
K	— WASHER	120396
L	— WASHER	120384
M	— NUT	120371
N	— ELBOW	142735
P	— VALVE, ASSY	7410950
	1—HOUSING	7374847
	2—VALVE	CC–1090402
	3—HOUSING	7374848
Q	— CLAMP	CC–1274556
R	— SCREW	123461
S	— ELBOW	444480
T	— VALVE, ASSY	7351346
	1—SCREW	132688
	2—SWIVEL	ANB–17X3
	3—PIN	112526
	4—WASHER	120392
	5—HANDLE	ANB–8X3
	6—VALVE, ASSY	CC–1273759
U	— NUT	120369
V	— STUD	CC–605773
W	— SCREW	7351194
X	— NUT	7378249
Y	— WASHER	7351195
Z	— STUD	7378248
AA	— GASKET	7056239
BB	— MANIFOLD, ASSY	8327998
CC	— GASKET	7410868
DD	— SPRAY	DV–PR3–37
EE	— TEE	CC–928515
FF	— NUT	119342
GG	— EXTENSION	CC–929058
HH	— GASKET	7410870
JJ	— MANIFOLD	CC–1066051
KK	— WASHER	120392
LL	— WASHER	121753
MM	— NUT	422890
NN	— WASHER	120380
PP	— NUT	120367

PISTON AND RINGS



KEY	ITEM	PART NO.
A	—RING SET	7347580
B	—PISTON, ASSY	7705766
1	—RING	7702467
2	—PISTON	NOT SERVICED
3	—PIN	7351350
C	—ROD, ASSY	7351230
1	—BOLT	7351231
2	—WASHER	7702466
3	—NUT	7702657
4	—BEARING	7702594
D	—BEARING	7705763

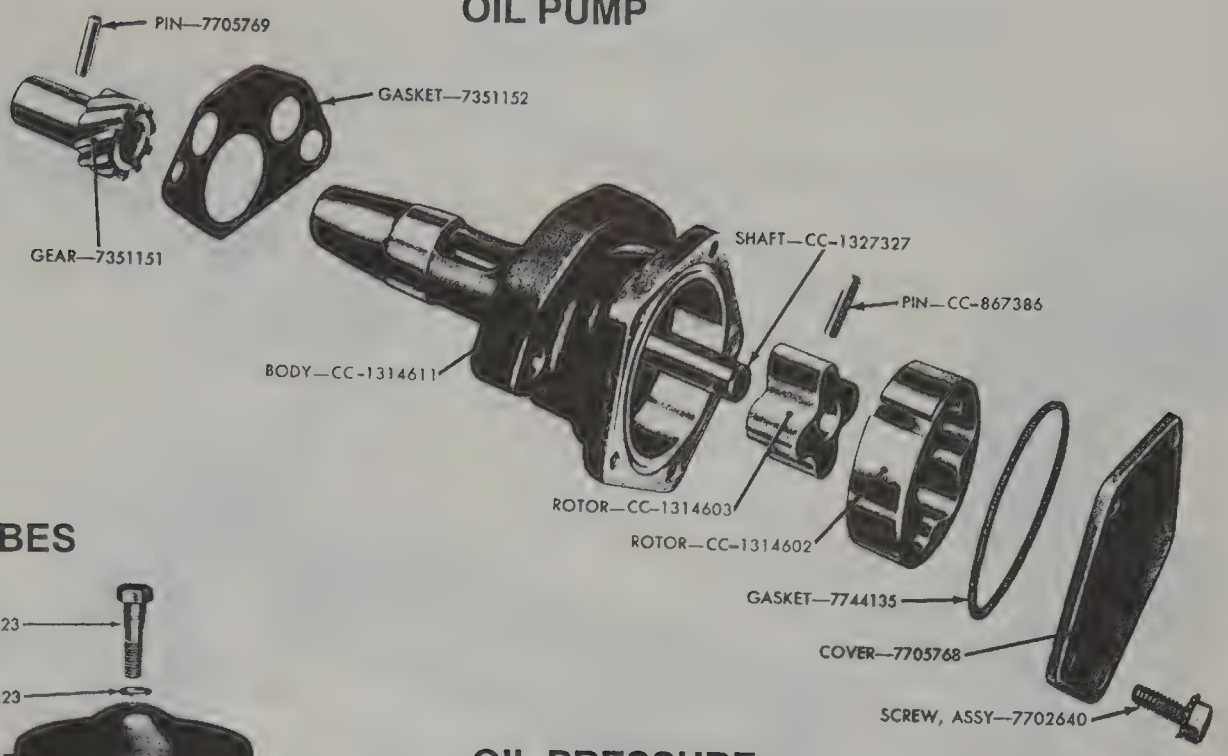
ENGINE MOUNTINGS



KEY	ITEM	PART NO.
A	—PLATE	7373657
B	—CUSHION	7351297
C	—BOLT	7373656
D	—WASHER	446494
E	—INSULATOR	7373654
F	—INSULATOR	7373655
G	—SPACER	7373658
H	—PIN	108636

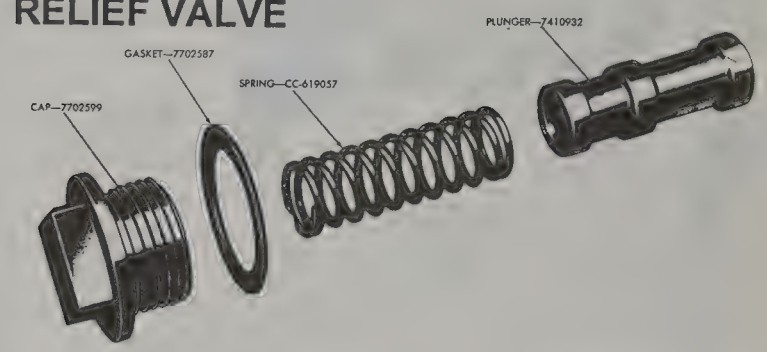
KEY	ITEM	PART NO.
J	—NUT	125250
K	—WASHER	120396
L	—SCREW	120424
M	—WASHER	120390
N	—WASHER	120384
P	—NUT	120371
Q	—NUT	120368
R	—WASHER	120214

OIL PUMP

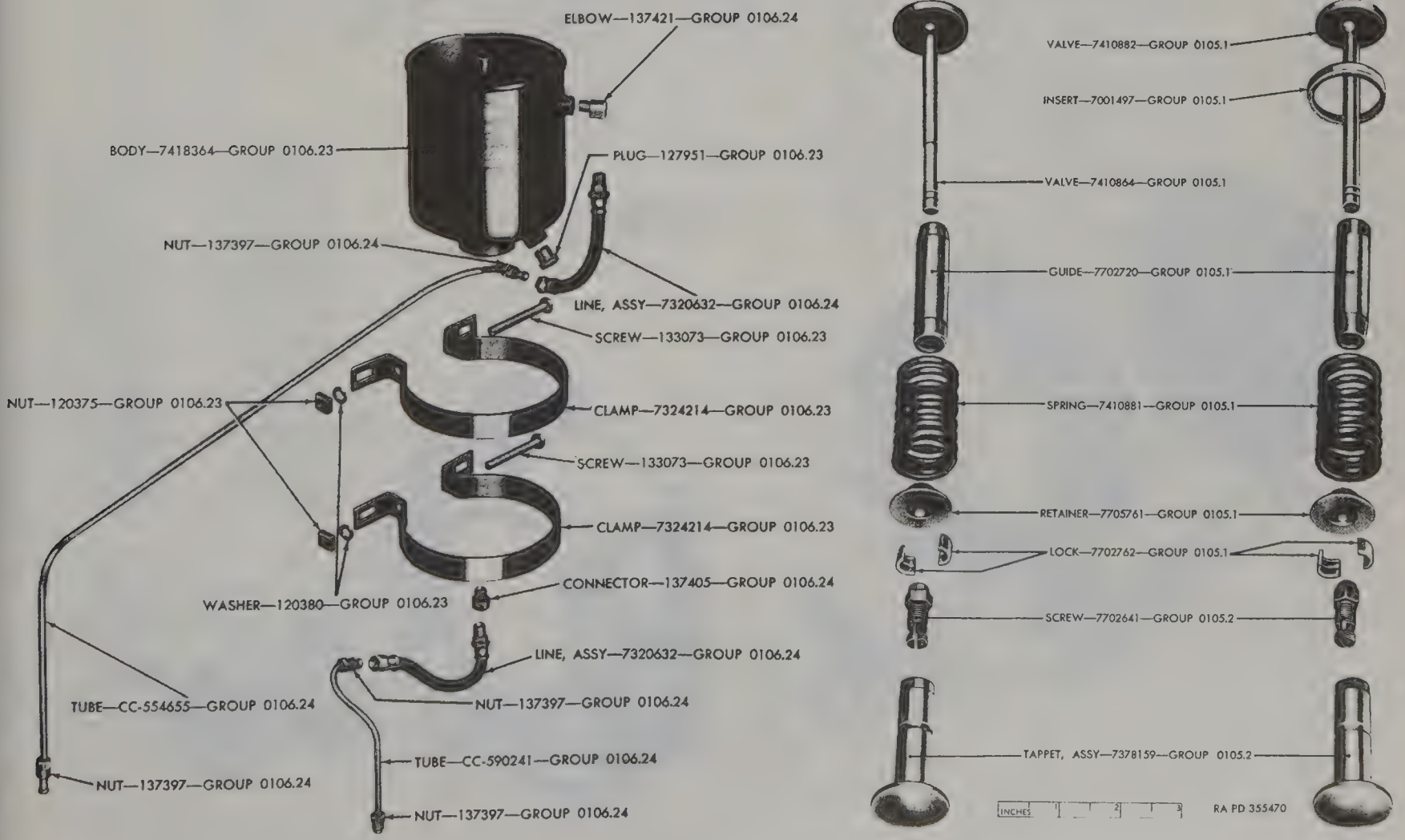


OIL FILTER AND TUBES

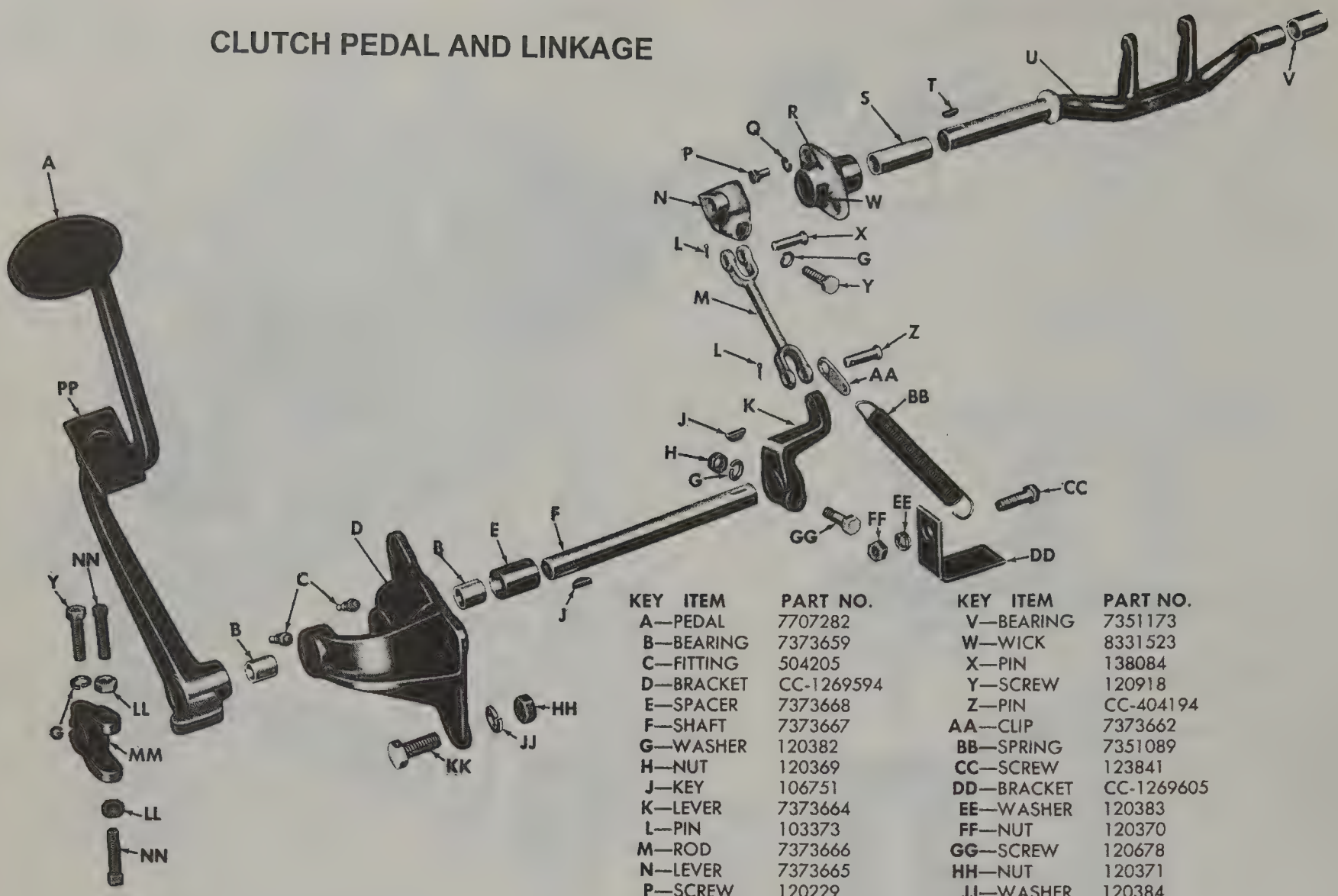
OIL PRESSURE RELIEF VALVE



VALVES AND TAPPETS

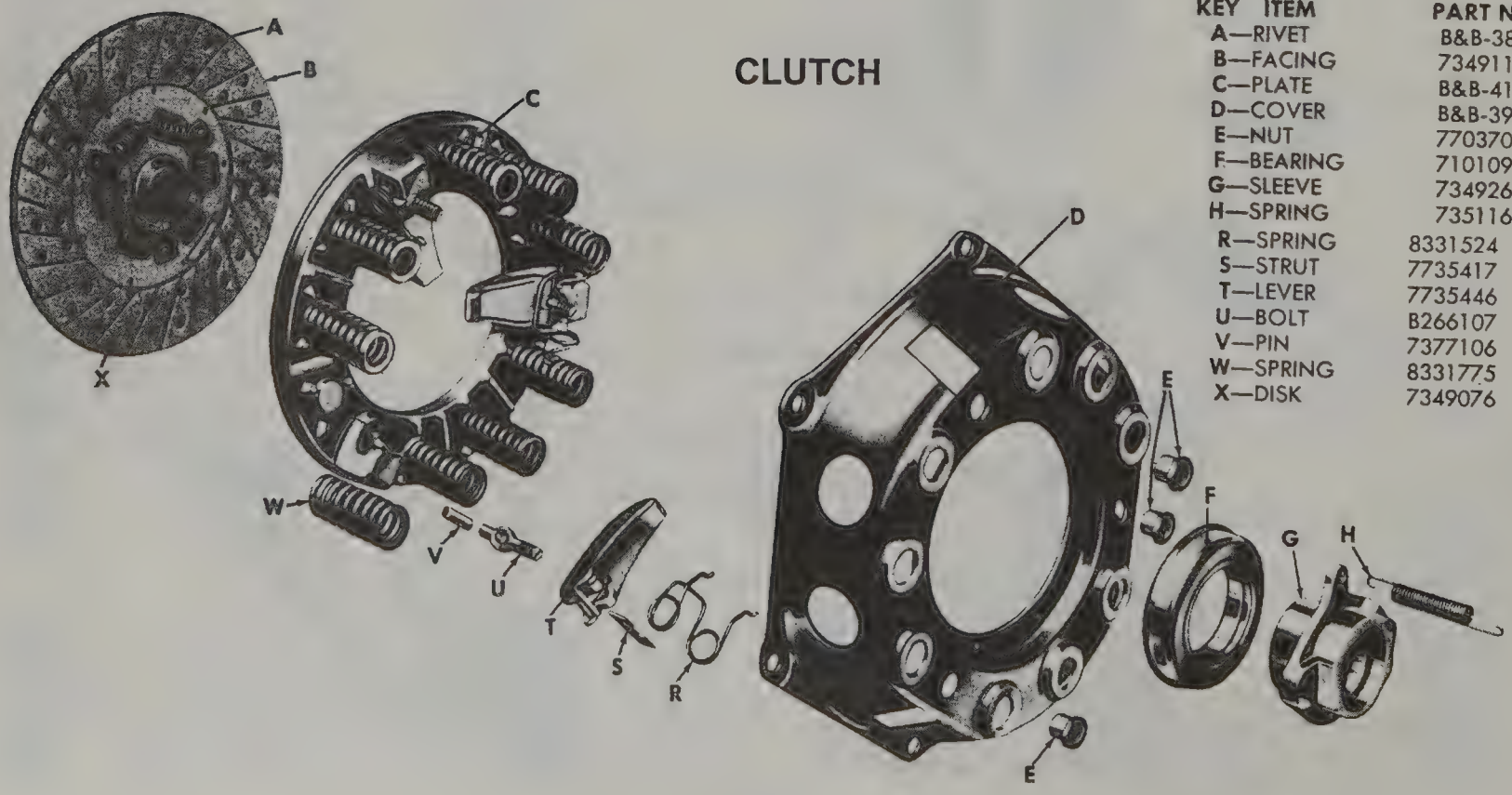


CLUTCH PEDAL AND LINKAGE



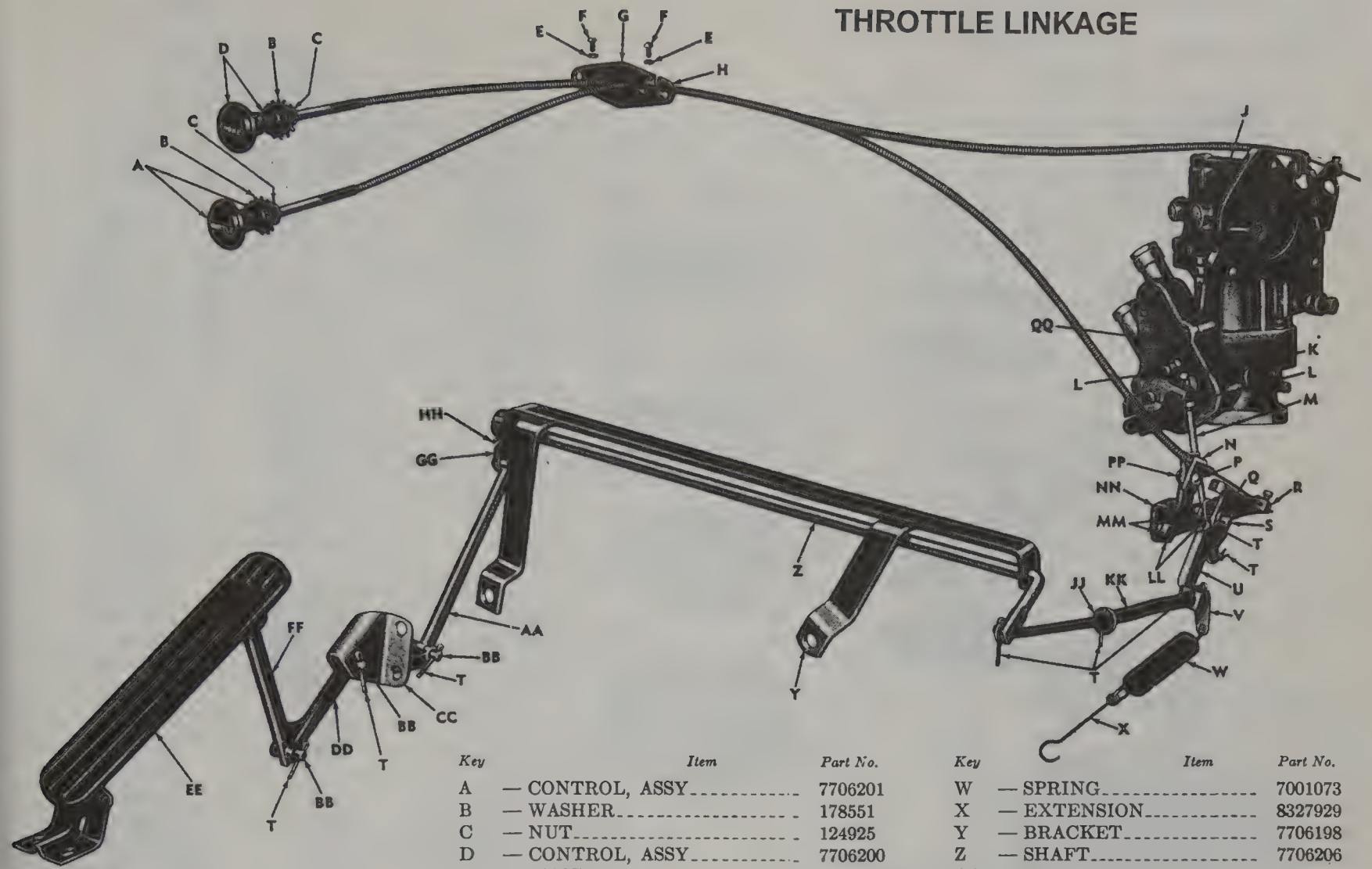
KEY	ITEM	PART NO.	KEY	ITEM	PART NO.
A	PEDAL	7707282	V	BEARING	7351173
B	BEARING	7373659	W	WICK	8331523
C	FITTING	504205	X	PIN	138084
D	BRACKET	CC-1269594	Y	SCREW	120918
E	SPACER	7373668	Z	PIN	CC-404194
F	SHAFT	7373667	AA	CLIP	7373662
G	WASHER	120382	BB	SPRING	7351089
H	NUT	120369	CC	SCREW	123841
J	KEY	106751	DD	BRACKET	CC-1269605
K	LEVER	7373664	EE	WASHER	120383
L	PIN	103373	FF	NUT	120370
M	ROD	7373666	GG	SCREW	120678
N	LEVER	7373665	HH	NUT	120371
P	SCREW	120229	JJ	WASHER	120384
Q	WASHER	120214	KK	SCREW	120234
R	FLANGE	CC-56813	LL	NUT	120377
S	BEARING	7372666	MM	COLLAR	7351171
T	KEY	103907	NN	SCREW	143138
U	FORK	7373663	PP	PAD	7351174

CLUTCH



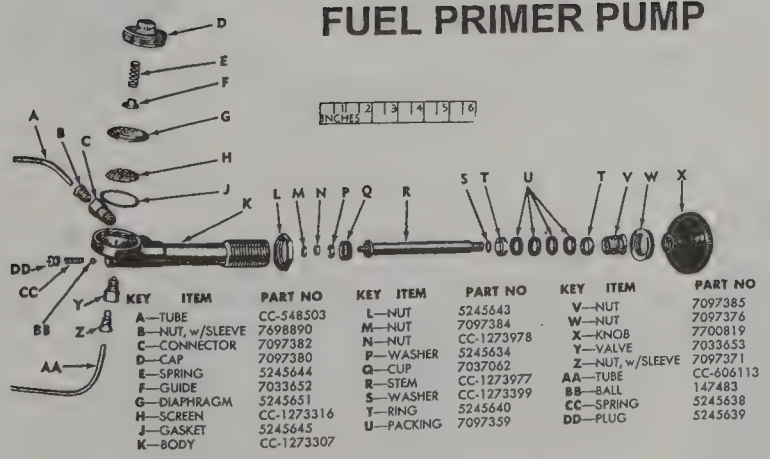
KEY	ITEM	PART NO.
A	RIVET	B&B-3875
B	FACING	7349110
C	PLATE	B&B-4117
D	COVER	B&B-3953
E	NUT	7703707
F	BEARING	710109
G	SLEEVE	7349265
H	SPRING	7351168
R	SPRING	8331524
S	STRUT	7735417
T	LEVER	7735446
U	BOLT	B266107
V	PIN	7377106
W	SPRING	8331775
X	DISK	7349076

THROTTLE LINKAGE



Key	Item	Part No.	Key	Item	Part No.
A	— CONTROL, ASSY	7706201	W	— SPRING	7001073
B	— WASHER	178551	X	— EXTENSION	8327929
C	— NUT	124925	Y	— BRACKET	7706198
D	— CONTROL, ASSY	7706200	Z	— SHAFT	7706206
E	— WASHER	138479	AA	— ROD	7706202
F	— SCREW	132900	BB	— PIN	121741
G	— CLAMP	7411752	CC	— BRACKET	7706199
H	— BRACKET	7411751	DD	— LEVER	7372627
J	— CARBURETOR, ASSY	7001053	EE	— PEDAL	7351349
K	— JOINT	116425	FF	— ROD	7706203
L	— NUT	120614	GG	— LEVER	7349042
M	— ROD	7001055	HH	— PIN	103563
N	— CLIP	7346874	JJ	— ROD, w/WASHER	7413239
P	— SCREW	120221	KK	— SPRING	7351081
Q	— WASHER	120217	LL	— SCREW	120228
R	— LEVER	7351079	MM	— WASHER	120214
S	— STUD	7351080	NN	— BRACKET	7351078
T	— PIN	103373	PP	— NUT	120361
U	— BELLCRANK, ASSY	7351077	QQ	— WASHER	120391
V	— CLIP	7351211			

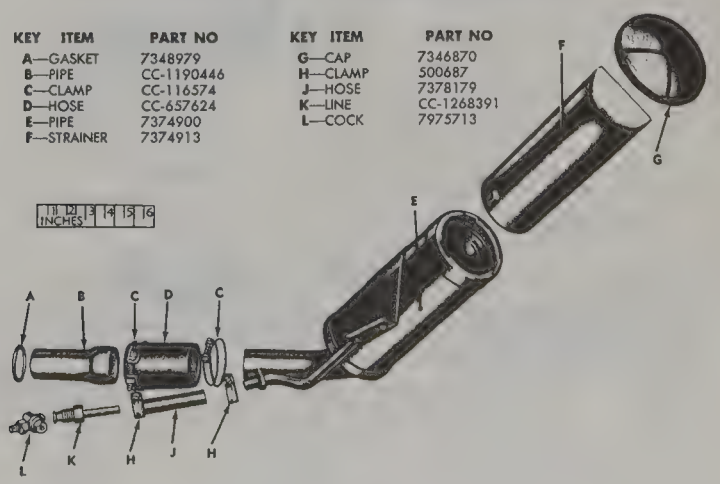
FUEL PRIMER PUMP



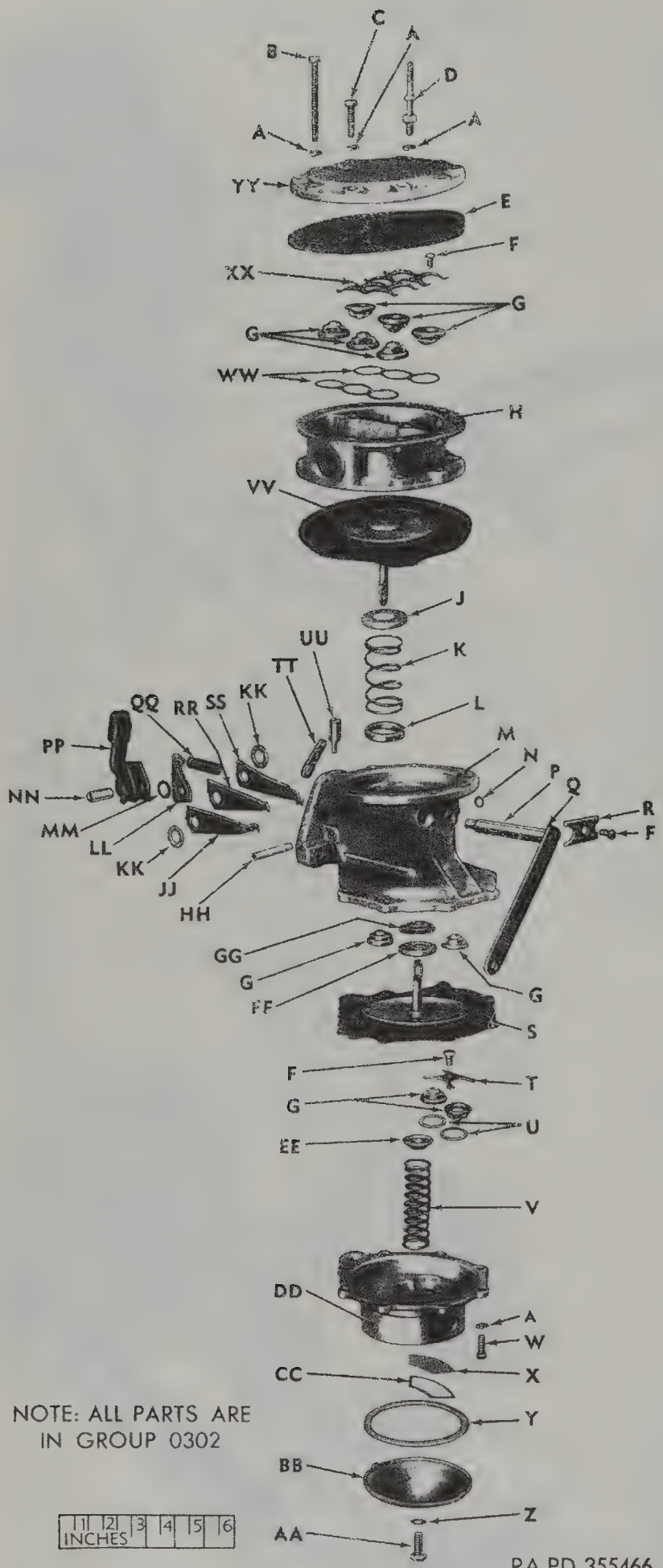
Key	Item	Part No.	Key	Item	Part No.	Key	Item	Part No.
A	—TUBE	CC-548503	L	—NUT	5245643	V	—NUT	7097385
B	—NUT, w/SLEEVE	7698890	M	—NUT	7097384	W	—NUT	7097376
C	—CONNECTOR	7097382	N	—NUT	CC-1273978	X	—KNOB	7700819
D	—CAP	7097380	P	—WASHER	5245634	Y	—VALVE	7033653
E	—SPRING	5245644	Q	—CUP	7037062	Z	—NUT, w/SLEEVE	7097371
F	—GUIDE	7033652	R	—STEM	CC-1273977	AA	—TUBE	CC-606113
G	—DIAPHRAGM	5245651	S	—WASHER	CC-1273399	BB	—BALL	147483
H	—SCREEN	CC-1273316	T	—RING	5245640	CC	—SPRING	5245638
J	—GASKET	5245645	U	—PACKING	7097359	DD	—PLUG	5245639
K	—BODY	CC-1273307						

FUEL FILLER TUBE AND CAP

Key	Item	Part No.	Key	Item	Part No.
A	—GASKET	7348979	G	—CAP	7346870
B	—PIPE	CC-1190446	H	—CLAMP	500687
C	—CLAMP	CC-116574	J	—HOSE	7378179
D	—HOSE	CC-657624	K	—LINE	CC-1268391
E	—PIPE	7374900	L	—COCK	7975713
F	—STRAINER	7374913			



FUEL PUMP

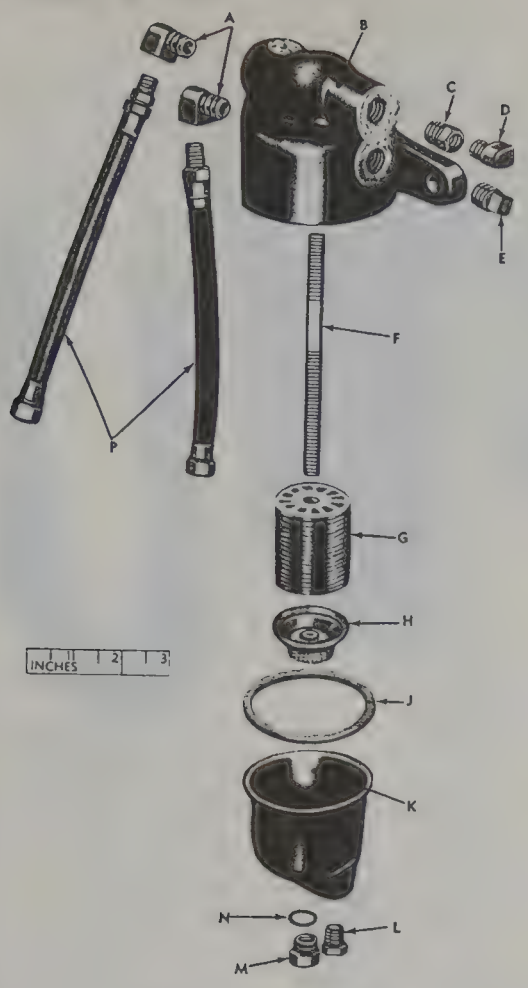


NOTE: ALL PARTS ARE IN GROUP 0302

RA PD 355466

Key	*Item*	*Part No.*
A	— WASHER	120217
B	— SCREW	7010694
C	— SCREW	132124
D	— STUD	7521167
E	— DIAPHRAGM	7001905
F	— SCREW	132900
G	— VALVE, ASSY	7416495
H	— BODY	7373363
J	— RETAINER	A214746
K	— SPRING	A323138
L	— SPACER	AC–5592243
M	— BODY, ASSY	AC–5592411
N	— WASHER	A214987
P	— LEVER	7350191
Q	— SEAL	7010699
R	— CLIP	7375950
S	— DIAPHRAGM, ASSY	AC–5592402
T	— RETAINER	A214750
U	— GASKET	A214752
V	— SPRING	AC–5590533
W	— SCREW	7326339
X	— SCREEN	A214758
Y	— GASKET	7413199
Z	— GASKET	A214764
AA	— SCREW	123461
BB	— COVER	6170220
CC	— RETAINER	A214759
DD	— BODY	AC–5591766
EE	— SEAT	A214761
FF	— RETAINER	8329706
GG	— SEAL	AC–5592331
HH	— PIN	7702746
JJ	— LINK	AC–1521907
KK	— WASHER	A214743
LL	— SPACER	AC–5590392
MM	— SPACER	A292984
NN	— BEARING	A214741
PP	— ARM	7413200
QQ	— SPRING	A214744
RR	— LINK	AC–1521906
SS	— LINK	AC–1521908
TT	— LINK	8329703
UU	— ROD, ASSY	8329707
VV	— DIAPHRAGM, ASSY	AC–5592359
WW	— GASKET	AC–5591830
XX	— RETAINER	7010695
YY	— COVER	7016403

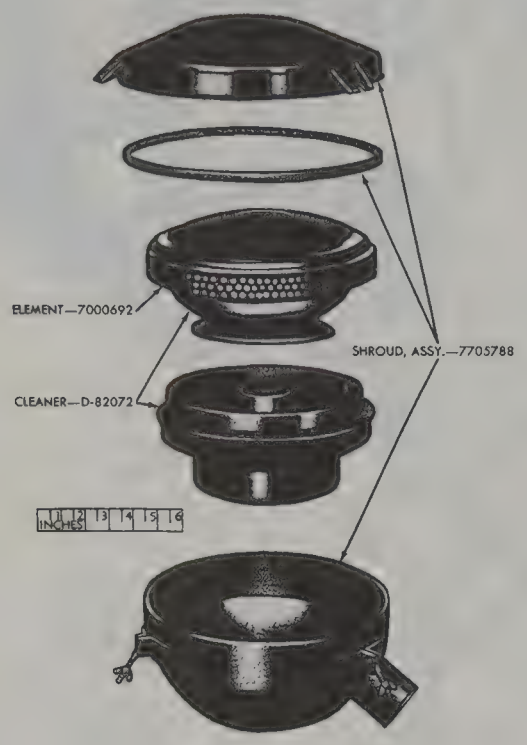
FUEL FILTER



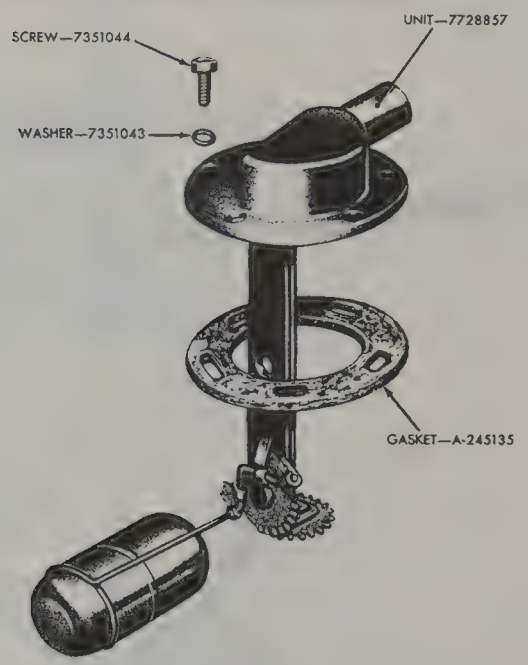
KEY	ITEM	PART NO
A	ELBOW	143343
B	HEAD	Z-F7X167
C	BUSHING	119930
D	ELBOW	137420
E	PLUG	143933
F	STUD	7410176
G	ELEMENT	7410173

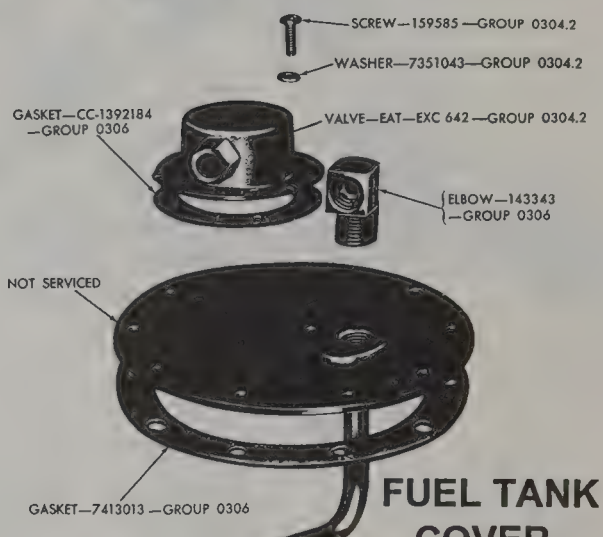
KEY	ITEM	PART NO
H	CUP	7410174
J	GASKET	7410175
K	BOWL	7410172
L	PLUG	127951
M	NUT	7410178
N	GASKET	7347647
P	LINE	7346872

AIR CLEANER



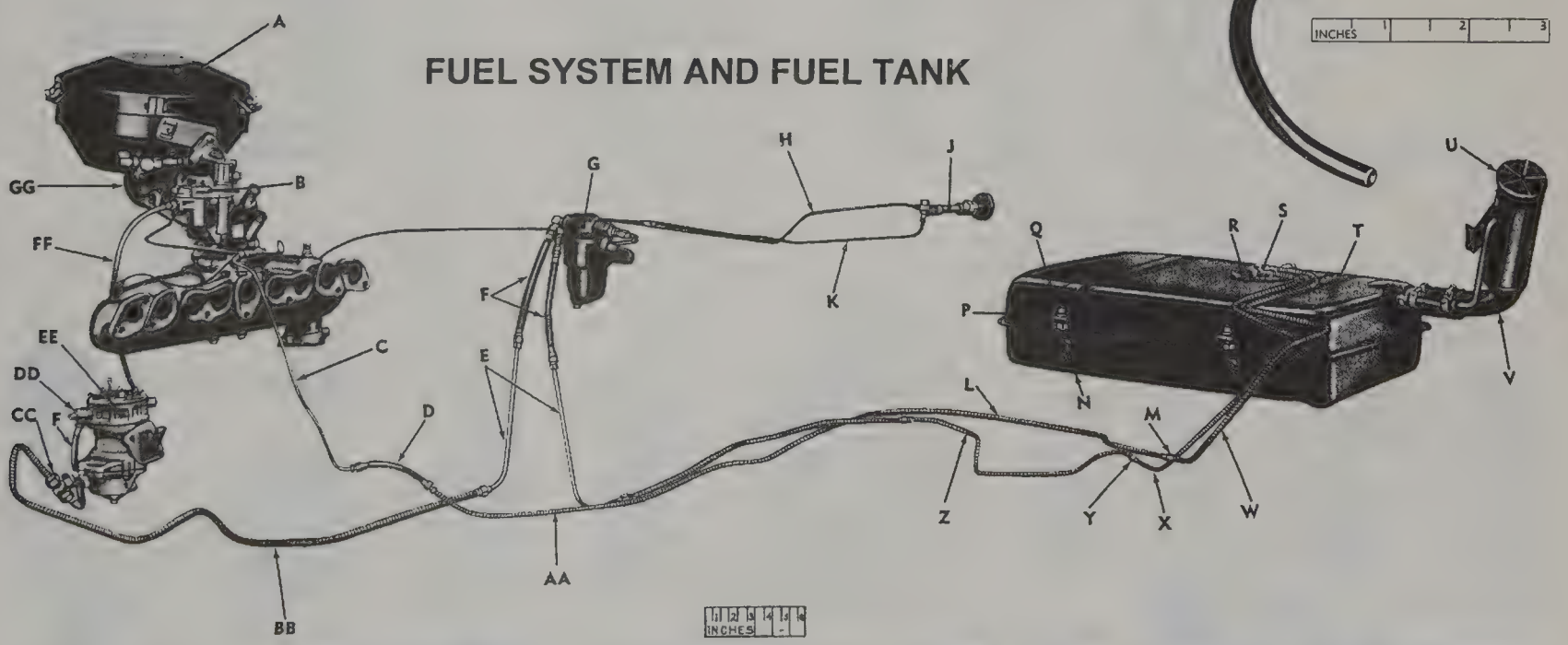
FUEL GAUGE SENDING UNIT





FUEL TANK COVER

FUEL SYSTEM AND FUEL TANK

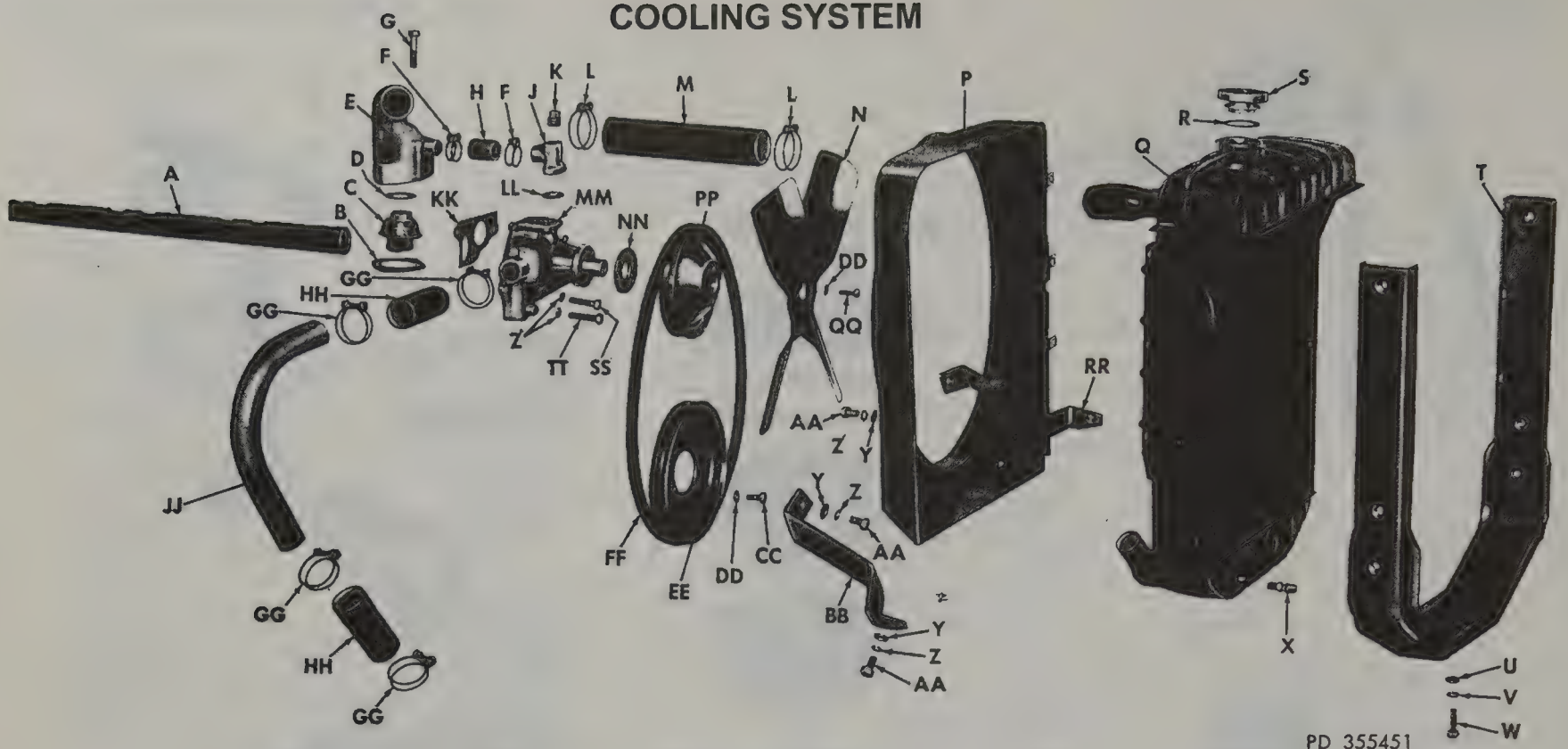


KEY	ITEM	PART NO	GROUP
A	SHROUD, ASSY	7705788	0304.1
B	CARBURETOR, ASSY	7001053	0301
C	LINE, ASSY	CC-1272541	0304.2
D	LINE, ASSY	8327963	0304.2
E	LINE, ASSY	CC-1274703	0306
F	LINE	7346872	0306
G	FILTER, ASSY	7413007	0306
H	LINE, ASSY	CC-1272219	0311
J	PUMP, ASSY	7410563	0311
K	LINE, ASSY	CC-1272220	0311
L	LINE, ASSY	CC-1274704	0306

KEY	ITEM	PART NO	GROUP
M	UNION	137414	0306
N	STRAP	7374911	0306
P	WASHER	120383	0306
Q	NUT	120370	0306
R	COVER	CC-1273761	0306
S	UNIT	7728857	0610
T	TANK	7374912	0306
U	CAP	7346870	0306
V	PIPE	7374900	0306
W	LINE, ASSY	CC-1269316	0306

KEY	ITEM	PART NO	GROUP
X	LINE, ASSY	CC-1272548	0304.2
Y	UNION	137412	0304.2
Z	LINE, ASSY	CC-1272544	0304.2
AA	LINE, ASSY	CC-1272542	0304.2
BB	LINE, ASSY	CC-1274708	0306
CC	COCK	7346871	0306
DD	ELBOW	WH-100-50205	0306
EE	PUMP, ASSY	7351345	0302
FF	LINE, ASSY	7346873	0306
GG	ELBOW	WH-1375	0304.2

COOLING SYSTEM



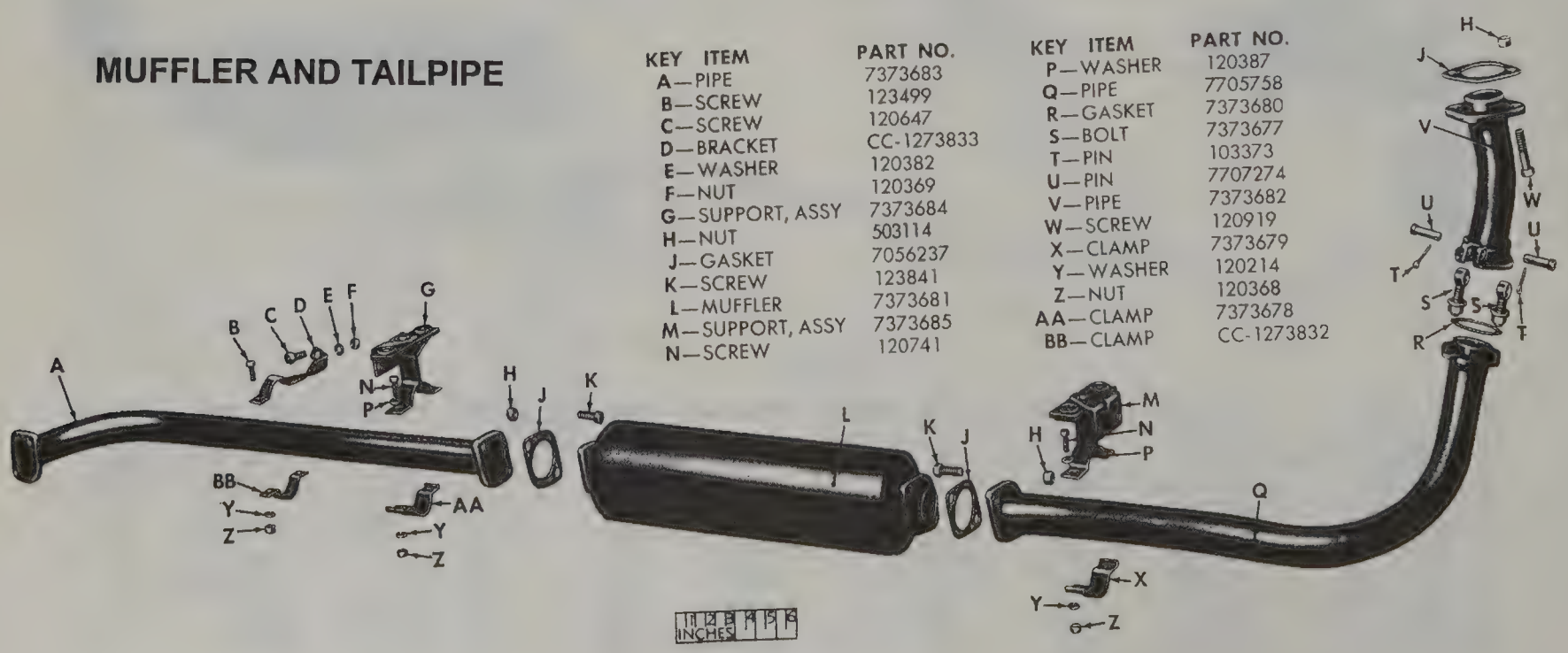
Key	Item	Part No.
A	— TUBE	7351075
B	— GASKET	7702588
C	— THERMOSTAT, ASSY	7411831
D	— GASKET	7702589
E	— ELBOW	7706210
F	— CLAMP	105475
G	— SCREW	122181
H	— HOSE	CC–869419
J	— ELBOW	7706211
K	— PLUG	103868
L	— CLAMP	105483
M	— HOSE	CC–1320132
N	— FAN, ASSY	7346790
P	— SHROUD	7373693
Q	— RADIATOR, ASSY	7373692
S	— CAP, ASSY	6246293
R	— GASKET	STN–6422
T	— SUPPORT	7373720
U	— WASHER	120390
V	— WASHER	120384
W	— SCREW	426965

Key	Item	Part No.
X	— COCK	585891
Y	— WASHER	120394
Z	— WASHER	120382
AA	— SCREW	120647
BB	— BRACKET	7373691
CC	— SCREW	123473
DD	— WASHER	120214
EE	— PULLEY	7705719
FF	— BELT	590895
GG	— CLAMP	502920
HH	— HOSE	CC–954141
JJ	— TUBE	7707281
KK	— GASKET	7351163
LL	— GASKET	7351074
MM	— PUMP, ASSY	CC–1326279
NN	— SPACER	7706194
PP	— PULLEY	7706192
QQ	— SCREW	122017
RR	— BRACKET	7373690
SS	— SCREW	CC–1407114
TT	— SCREW	CC–1407115

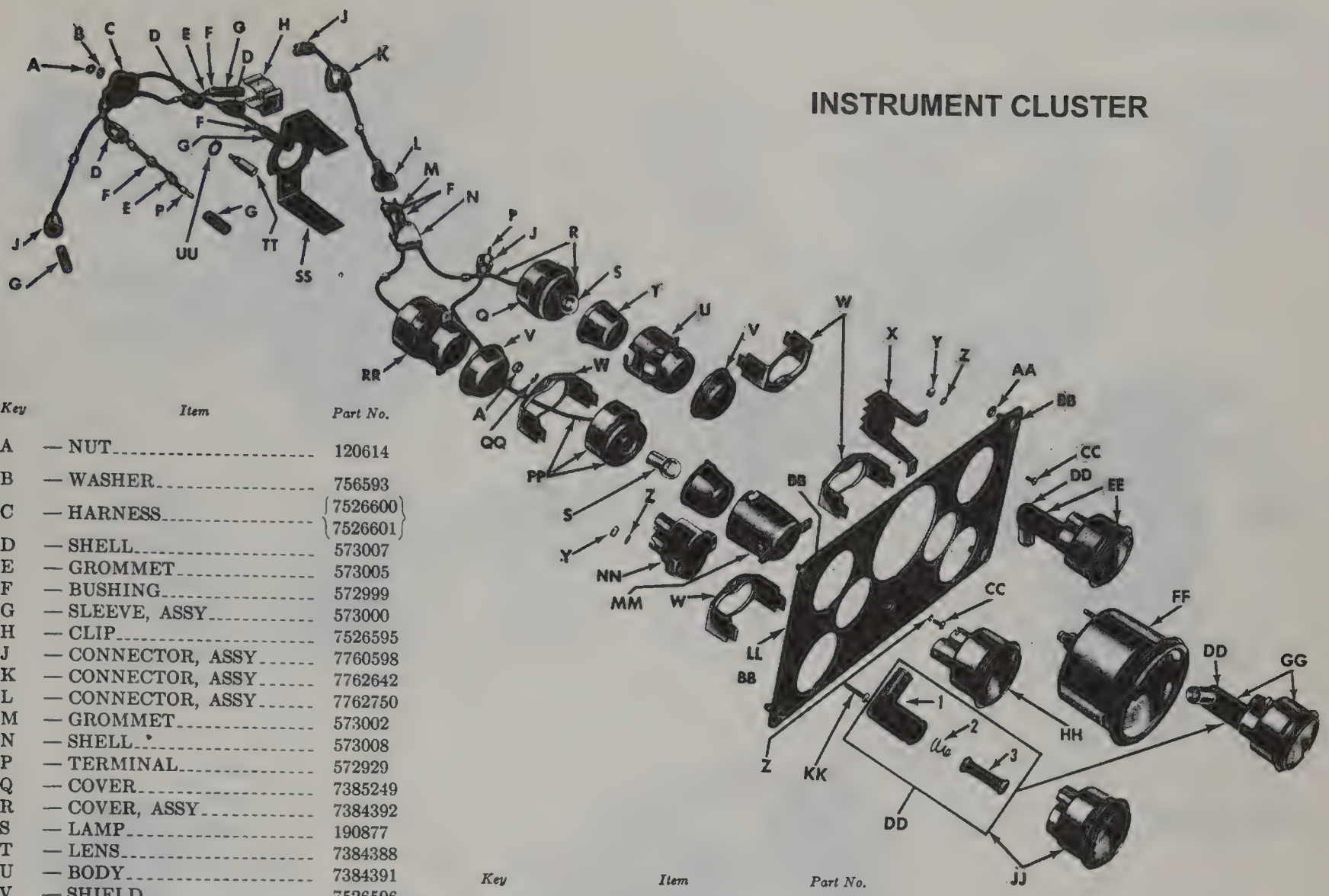
MUFFLER AND TAILPIPE

KEY	ITEM	PART NO.
A	PIPE	7373683
B	SCREW	123499
C	SCREW	120647
D	BRACKET	CC-1273833
E	WASHER	120382
F	NUT	120369
G	SUPPORT, ASSY	7373684
H	NUT	503114
J	GASKET	7056237
K	SCREW	123841
L	MUFFLER	7373681
M	SUPPORT, ASSY	7373685
N	SCREW	120741

KEY	ITEM	PART NO.
P	WASHER	120387
Q	PIPE	7705758
R	GASKET	7373680
S	BOLT	7373677
T	PIN	103373
U	PIN	7707274
V	PIPE	7373682
W	SCREW	120919
X	CLAMP	7373679
Y	WASHER	120214
Z	NUT	120368
AA	CLAMP	7373678
BB	CLAMP	CC-1273832



INSTRUMENT CLUSTER



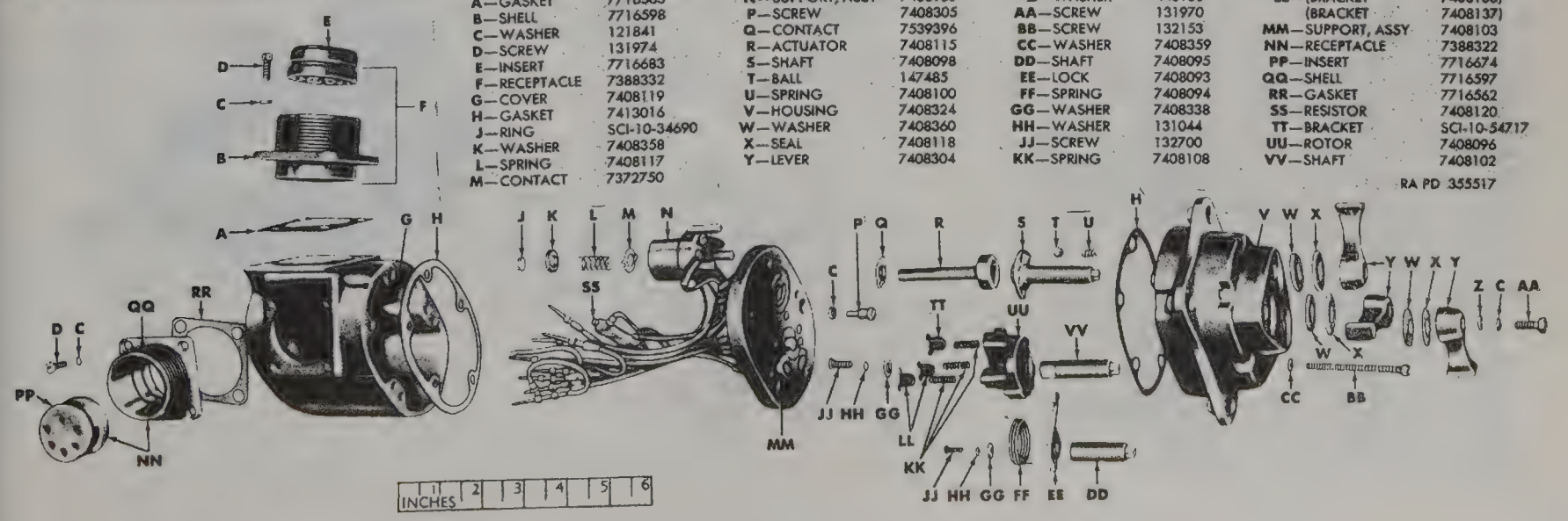
Key	Item	Part No.
A	— NUT	120614
B	— WASHER	756593
C	— HARNESS	7526600 / 7526601
D	— SHELL	573007
E	— GROMMET	573005
F	— BUSHING	572999
G	— SLEEVE, ASSY	573000
H	— CLIP	7526595
J	— CONNECTOR, ASSY	7760598
K	— CONNECTOR, ASSY	7762642
L	— CONNECTOR, ASSY	7762750
M	— GROMMET	573002
N	— SHELL	573008
P	— TERMINAL	572929
Q	— COVER	7385249
R	— COVER, ASSY	7384392
S	— LAMP	190877
T	— LENS	7384388
U	— BODY	7384391
V	— SHIELD	7526596
W	— BRACKET	CC-1390018
X	— BRACKET, ASSY	7526598
Y	— NUT	120622
Z	— WASHER	121841
AA	— WASHER	7526591
BB	— STUD	7526590
CC	— SCREW	121832
DD	— CASE, ASSY	7539519
	1—CASE	(Not Serviced
	2—SPRING	7539517
	3—RESISTOR	7539516
EE	— GAGE, ASSY	7728852
FF	— SPEEDOMETER, ASSY	7760396
GG	— GAGE, ASSY	7728853

Key	Item	Part No.
HH	— AMMETER, ASSY / VOLTMETER, ASSY	7728854 / 7354232
JJ	— GAGE, ASSY	7728855 / 7389567
KK	— SCREW	132776
LL	— PLATE	7526602
MM	— BODY	7384390
NN	— BREAKER, ASSY	7762620
PP	— COVER, ASSY	7384389
QQ	— WASHER	120217
RR	— LIGHT, ASSY	7760412
SS	— BRACKET	CC-1390022
TT	— STUD	7526594
UU	— WASHER	7526592

MASTER LIGHT SWITCH

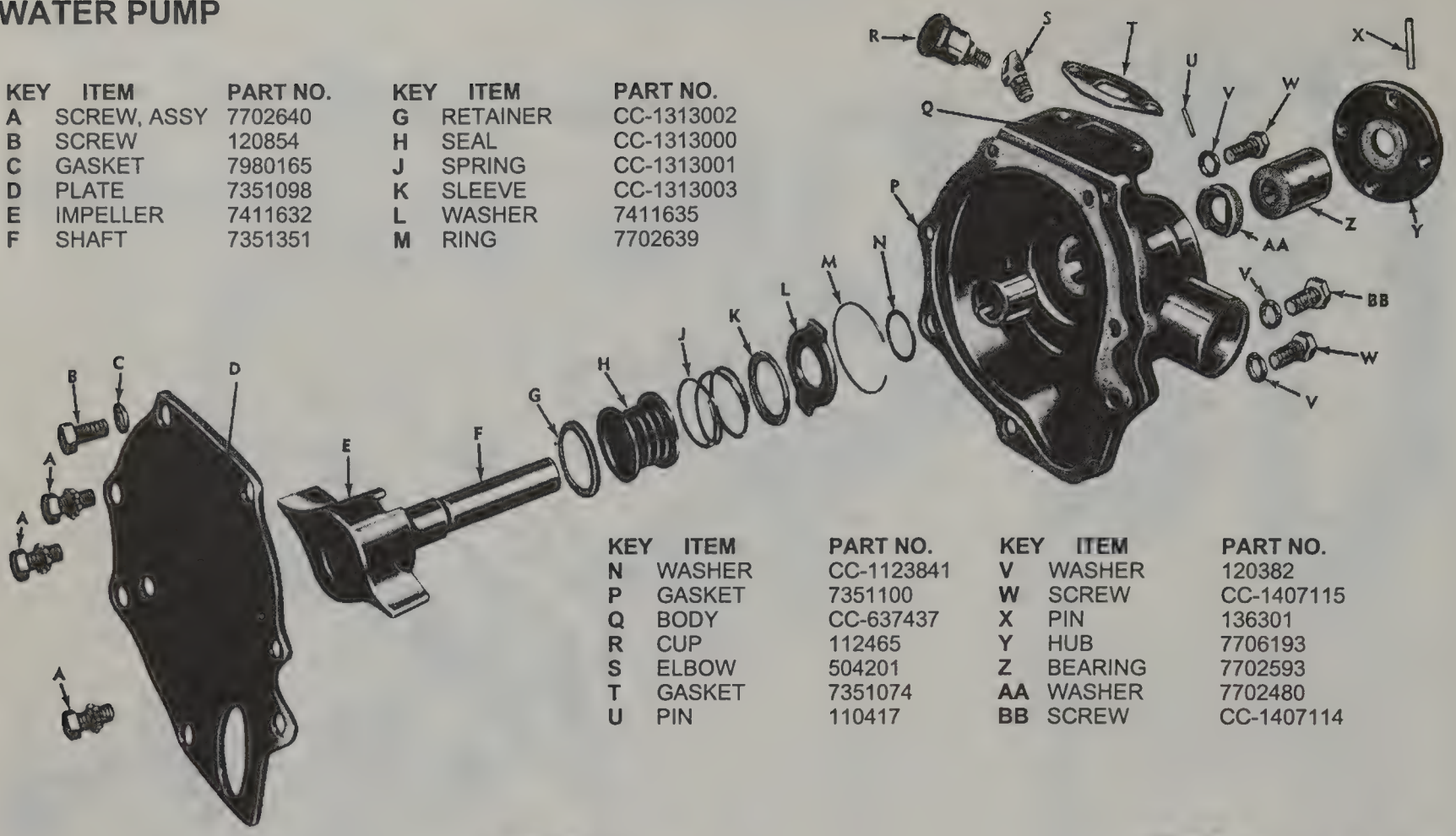
KEY	ITEM	PART NO
A	GASKET	7716563
B	SHELL	7716598
C	WASHER	121841
D	SCREW	131974
E	INSERT	7716683
F	RECEPTACLE	7388332
G	COVER	7408119
H	GASKET	7413016
J	RING	SCI-10-34690
K	WASHER	7408358
L	SPRING	7408117
M	CONTACT	7372750
N	SUPPORT, ASSY	7408135
P	SCREW	7408305
Q	CONTACT	7539396
R	ACTUATOR	7408115
S	SHAFT	7408098
T	BALL	147485
U	SPRING	7408100
V	HOUSING	7408324
W	WASHER	7408360
X	SEAL	7408118
Y	LEVER	7408304
Z	WASHER	446130
AA	SCREW	131970
BB	SCREW	132153
CC	WASHER	7408359
DD	SHAFT	7408095
EE	LOCK	7408093
FF	SPRING	7408094
GG	WASHER	7408338
HH	WASHER	131044
JJ	SCREW	132700
KK	SPRING	7408108
LL	(BRACKET	7408136)
	(BRACKET	7408137)
MM	SUPPORT, ASSY	7408103
NN	RECEPTACLE	7388322
PP	INSERT	7716674
QQ	SHELL	7716597
RR	GASKET	7716562
SS	RESISTOR	7408120
TT	BRACKET	SCI-10-54717
UU	ROTOR	7408096
VV	SHAFT	7408102

RA PD 355517



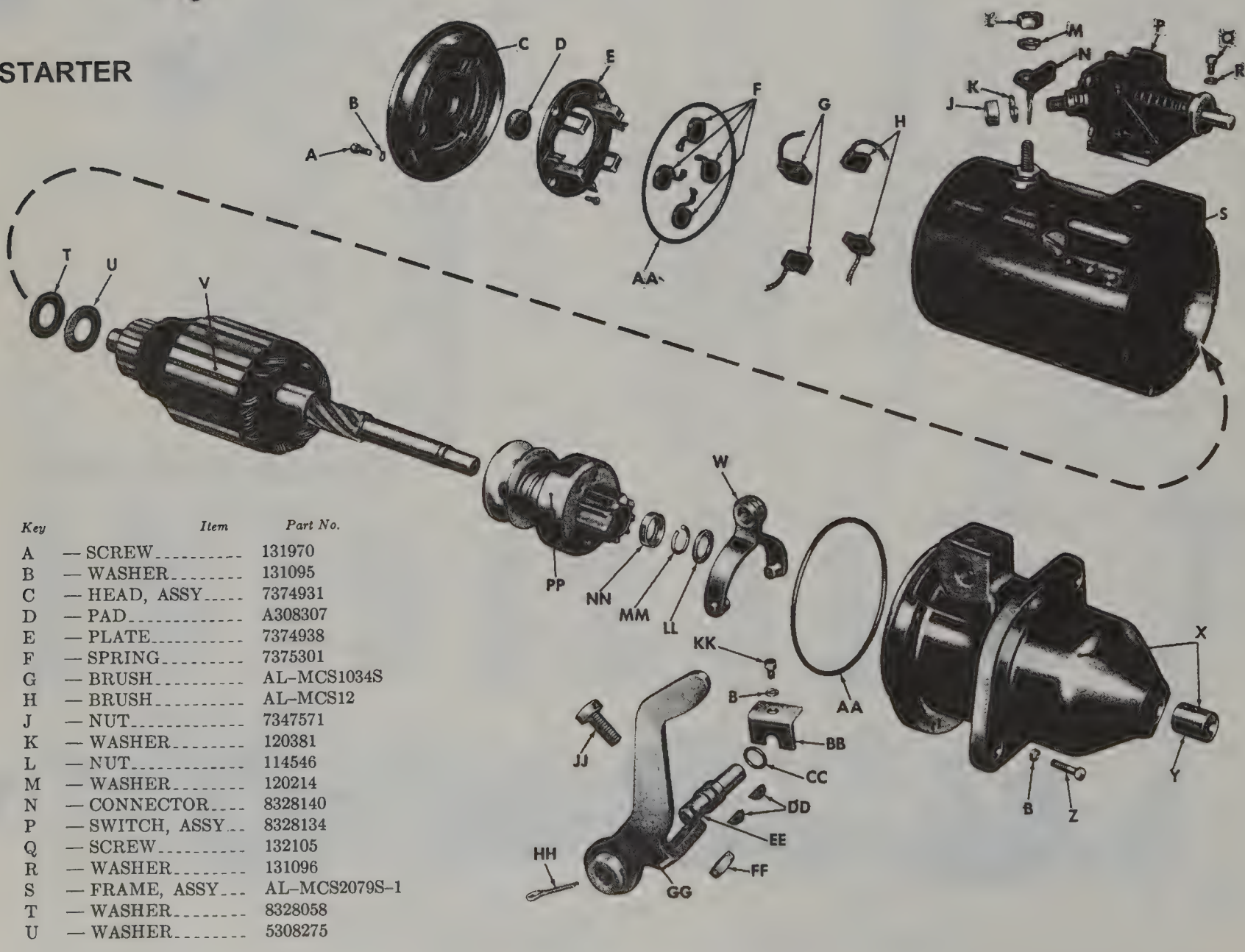
WATER PUMP

KEY	ITEM	PART NO.	KEY	ITEM	PART NO.
A	SCREW, ASSY	7702640	G	RETAINER	CC-1313002
B	SCREW	120854	H	SEAL	CC-1313000
C	GASKET	7980165	J	SPRING	CC-1313001
D	PLATE	7351098	K	SLEEVE	CC-1313003
E	IMPELLER	7411632	L	WASHER	7411635
F	SHAFT	7351351	M	RING	7702639



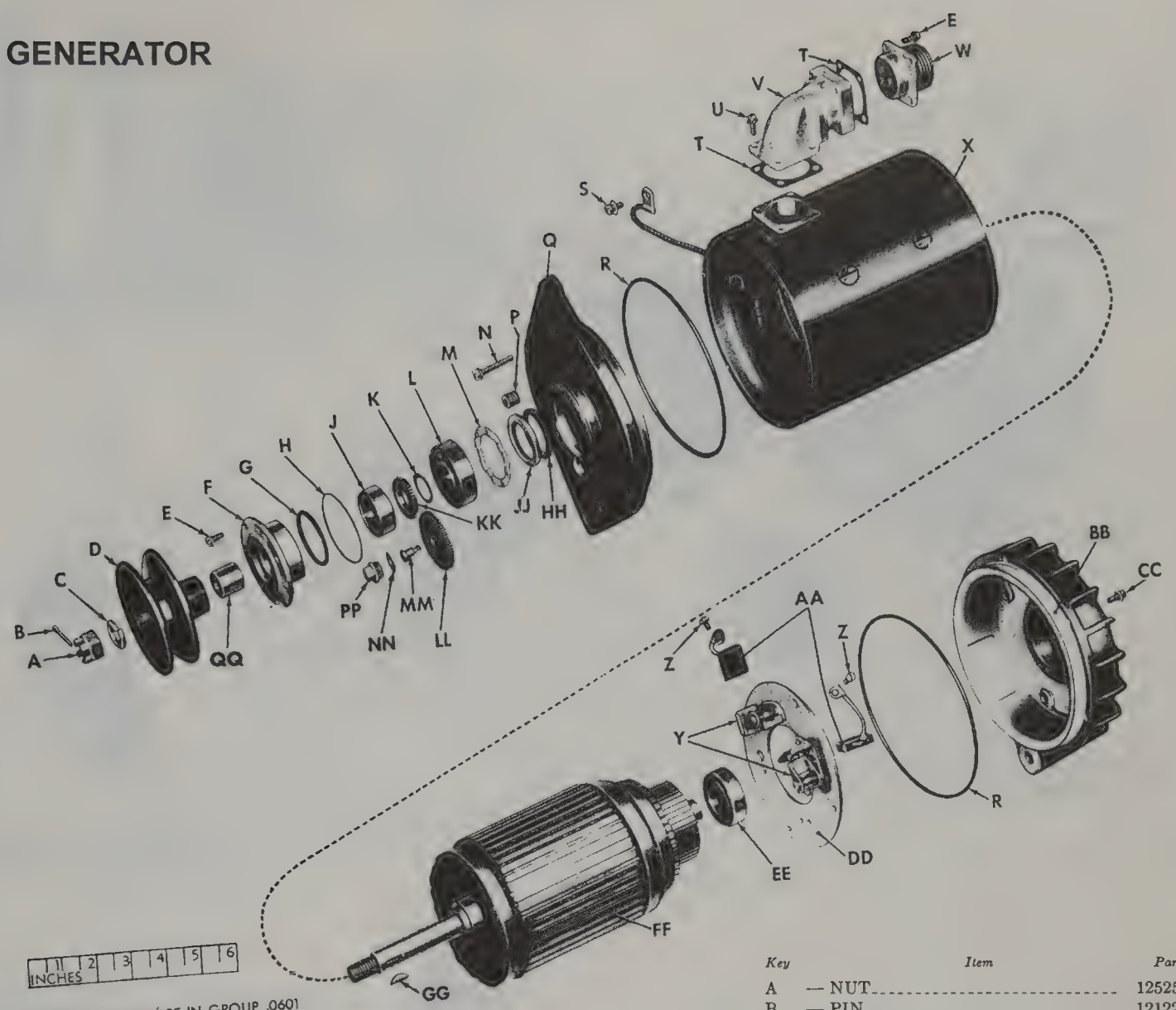
KEY	ITEM	PART NO.	KEY	ITEM	PART NO.
N	WASHER	CC-1123841	V	WASHER	120382
P	GASKET	7351100	W	SCREW	CC-1407115
Q	BODY	CC-637437	X	PIN	136301
R	CUP	112465	Y	HUB	7706193
S	ELBOW	504201	Z	BEARING	7702593
T	GASKET	7351074	AA	WASHER	7702480
U	PIN	110417	BB	SCREW	CC-1407114

STARTER



Key	*Item*	*Part No.*
A	— SCREW	131970
B	— WASHER	131095
C	— HEAD, ASSY	7374931
D	— PAD	A308307
E	— PLATE	7374938
F	— SPRING	7375301
G	— BRUSH	AL–MCS1034S
H	— BRUSH	AL–MCS12
J	— NUT	7347571
K	— WASHER	120381
L	— NUT	114546
M	— WASHER	120214
N	— CONNECTOR	8328140
P	— SWITCH, ASSY	8328134
Q	— SCREW	132105
R	— WASHER	131096
S	— FRAME, ASSY	AL–MCS2079S–1
T	— WASHER	8328058
U	— WASHER	5308275

GENERATOR



NOTE: ALL PARTS ARE IN GROUP .0601

Key	Item	Part No.
A	— NUT	125250
B	— PIN	121224
C	— WASHER	131101
D	— PULLEY	7374744
E	— SCREW, ASSY	AL–X3078
F	— RETAINER	7374855
G	— GASKET	501234
H	— GASKET	7375328
J	— SEAL	7374863
	GEAR	7374862
K	— WASHER	7374857
L	— BEARING	712125
M	— RETAINER	7374858
N	— SCREW	AL–X3079
P	— PLUG	444688
Q	— HEAD	7374748
R	— GASKET	7375330
S	— SCREW, ASSY	Not Avail.
T	— GASKET	7716562
U	— SCREW, ASSY	AL–X3051
V	— ELBOW	7716690
W	— RECEPTACLE	7388319
X	— FRAME, ASSY	7374851
Y	— ARM	8327721
Z	— SCREW, ASSY	AL–X3099
AA	— BRUSH SET	7374852
BB	— HEAD	7374749
CC	— SCREW, ASSY	AL–X3081
DD	— PLATE, ASSY	7374886
EE	— BEARING	712128
FF	— ARMATURE, ASSY	7374853
GG	— KEY	124545
HH	— WASHER	7374859
JJ	— RETAINER	7374860
KK	— GEAR	7374862
LL	— SLINGER	7374746
MM	— SHAFT	7374861
NN	— GASKET	7375329
PP	— PLUG	7374854
QQ	— SPACER	7374856

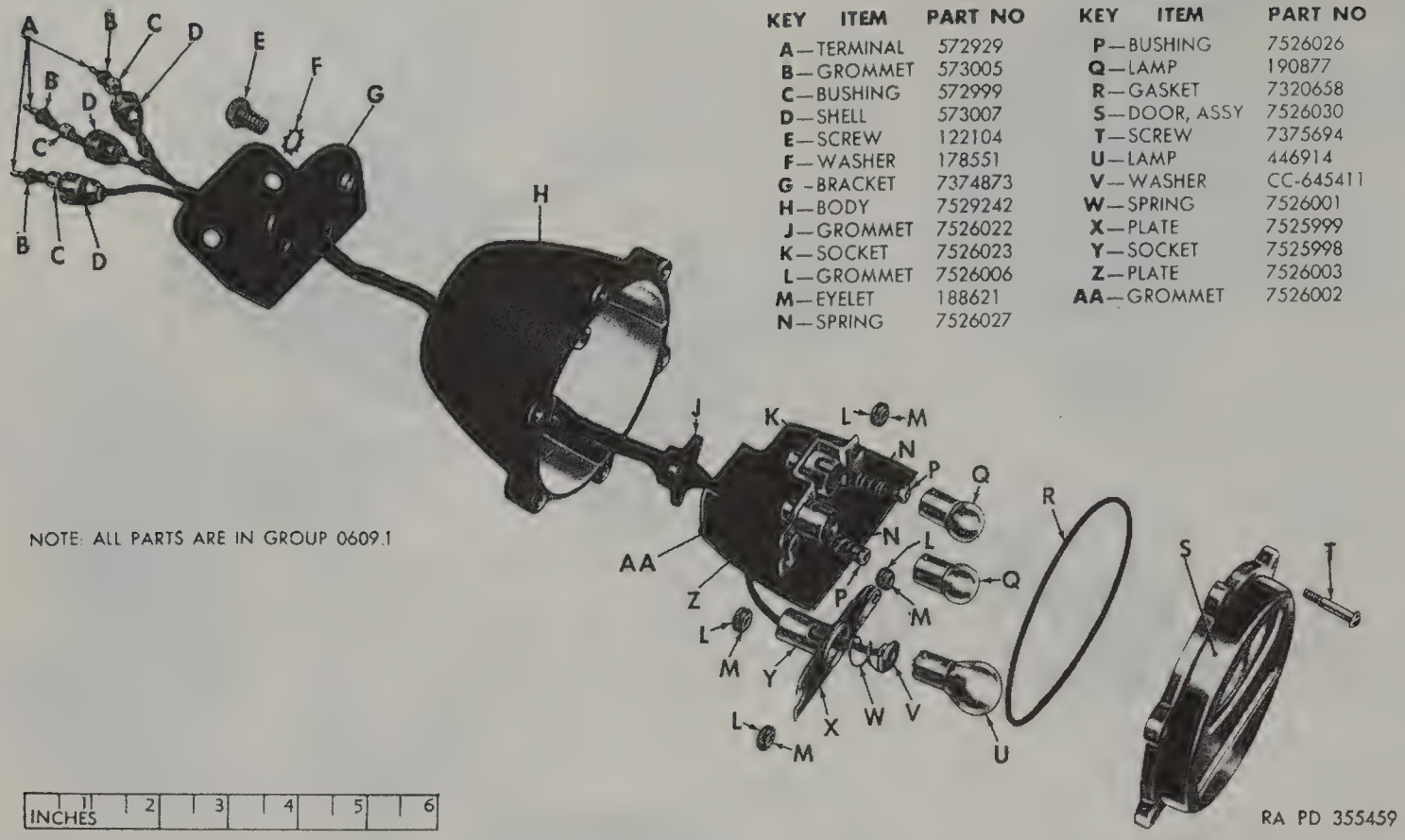
PARTS LIST CONTINUED FOR STARTER ASSEMBLY 7762617

Key	Item	Part No.
V	— ARMATURE	8328057
W	— YOKE	8328069
X	— HOUSING, ASSY	8328070
Y	— BEARING	A346762
Z	— SCREW	7375096
AA	— GASKET	546875
BB	— RETAINER	8328071
CC	— GASKET	501220
DD	— KEY	125543
EE	— SHAFT	8328067
FF	— NUT	124920
GG	— LEVER, ASSY	8328068
HH	— PIN	137185
JJ	— SCREW	123480
KK	— SCREW	131958
LL	— WASHER	7369888
MM	— RING	7347572
NN	— RETAINER	7374940
PP	— CLUTCH, ASSY	7369885

IMPORTANT NOTE:
The starter assembly pictured (7762617) is for vehicles with a serial number greater than 80023557 (March 1952). Earlier vehicles use starter assembly 7355783. The entire starter is interchangeable, but the parts in it are not.

BLACKOUT MARKER LIGHT

KEY	ITEM	PART NO
A	TERMINAL	572929
B	GROMMET	573005
C	BUSHING	572999
D	SHELL	573007
E	SCREW	122104
F	WASHER	178551
G	BRACKET	7374873
H	BODY	7529242
J	GROMMET	7526022
K	SOCKET	7526023
L	GROMMET	7526006
M	EYELET	188621
N	SPRING	7526027
P	BUSHING	7526026
Q	LAMP	190877
R	GASKET	7320658
S	DOOR, ASSY	7526030
T	SCREW	7375694
U	LAMP	446914
V	WASHER	CC-645411
W	SPRING	7526001
X	PLATE	7525999
Y	SOCKET	7525998
Z	PLATE	7526003
AA	GROMMET	7526002



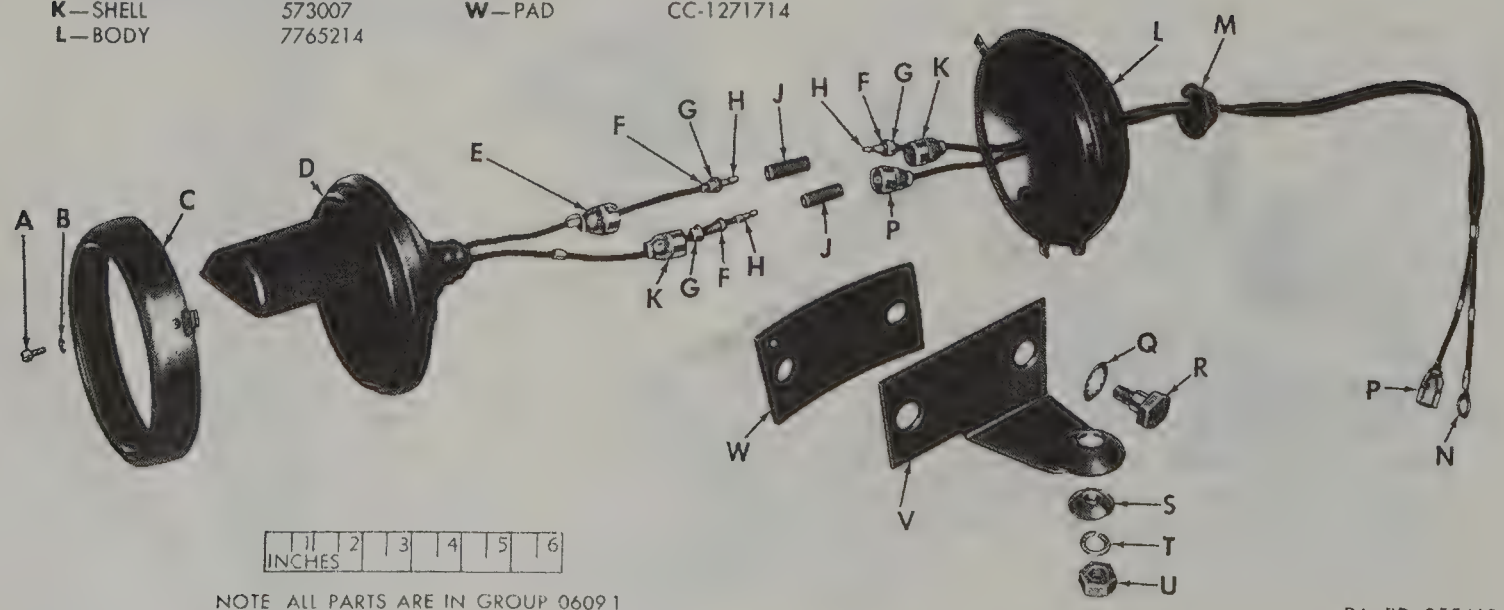
NOTE: ALL PARTS ARE IN GROUP 0609.1

INCHES 1 2 3 4 5 6

RA PD 355459

BLACKOUT HEADLIGHT

KEY	ITEM	PART NO
A	SCREW	7525938
B	RING	7525939
C	DOOR	7525940
D	LAMP UNIT, ASSY	451989
E	SHELL	573010
F	GROMMET	573005
G	BUSHING	572999
H	TERMINAL	572929
J	SLEEVE	573000
K	SHELL	573007
L	BODY	7765214
M	GROMMET	7525365
N	TERMINAL	200011
P	CONNECTOR	7760598
Q	WASHER	138557
R	SCREW	7374874
S	WASHER	A294507
T	WASHER	120382
U	NUT	120377
V	BRACKET	7374875
W	PAD	CC-1271714

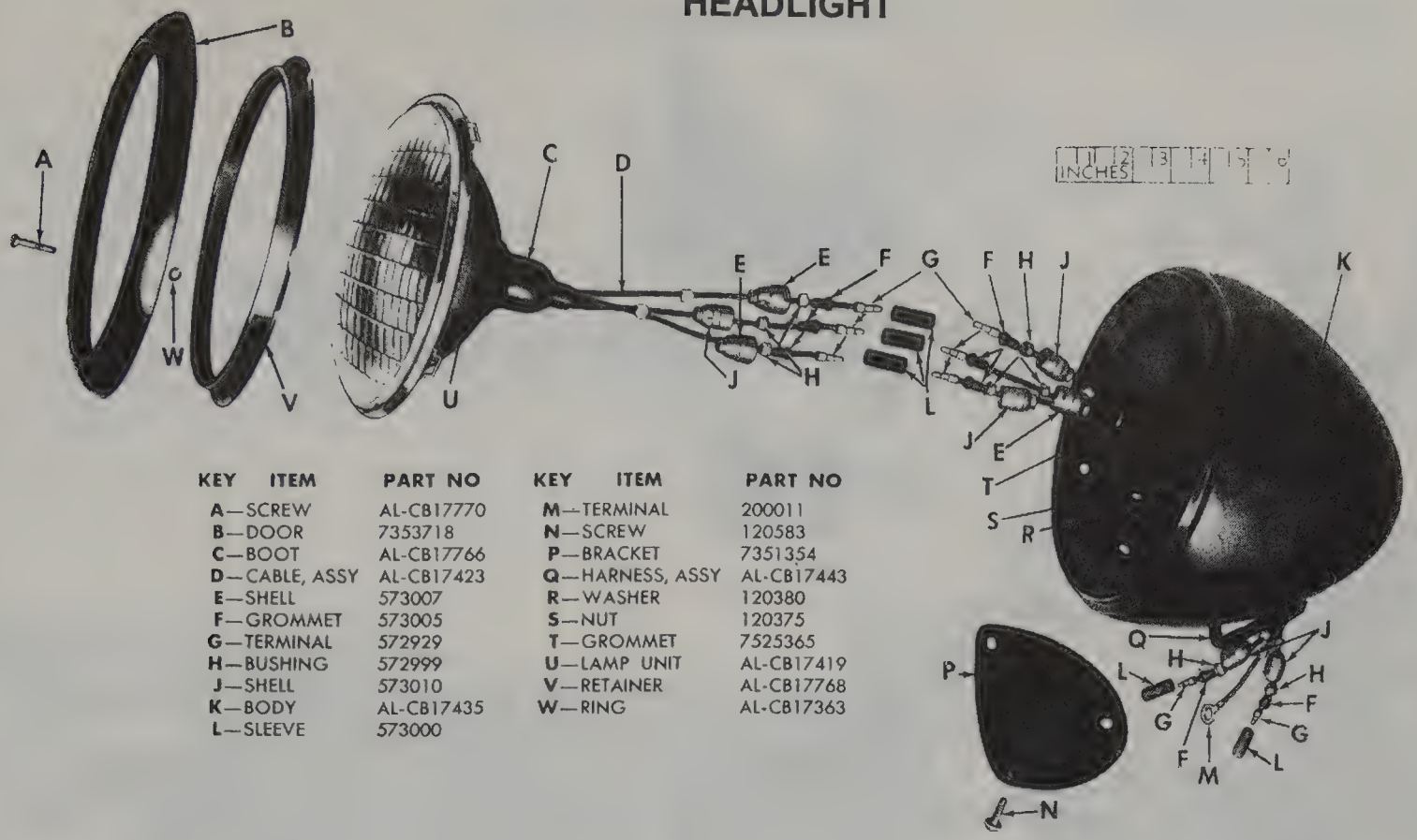


INCHES 1 2 3 4 5 6

NOTE ALL PARTS ARE IN GROUP 0609 1

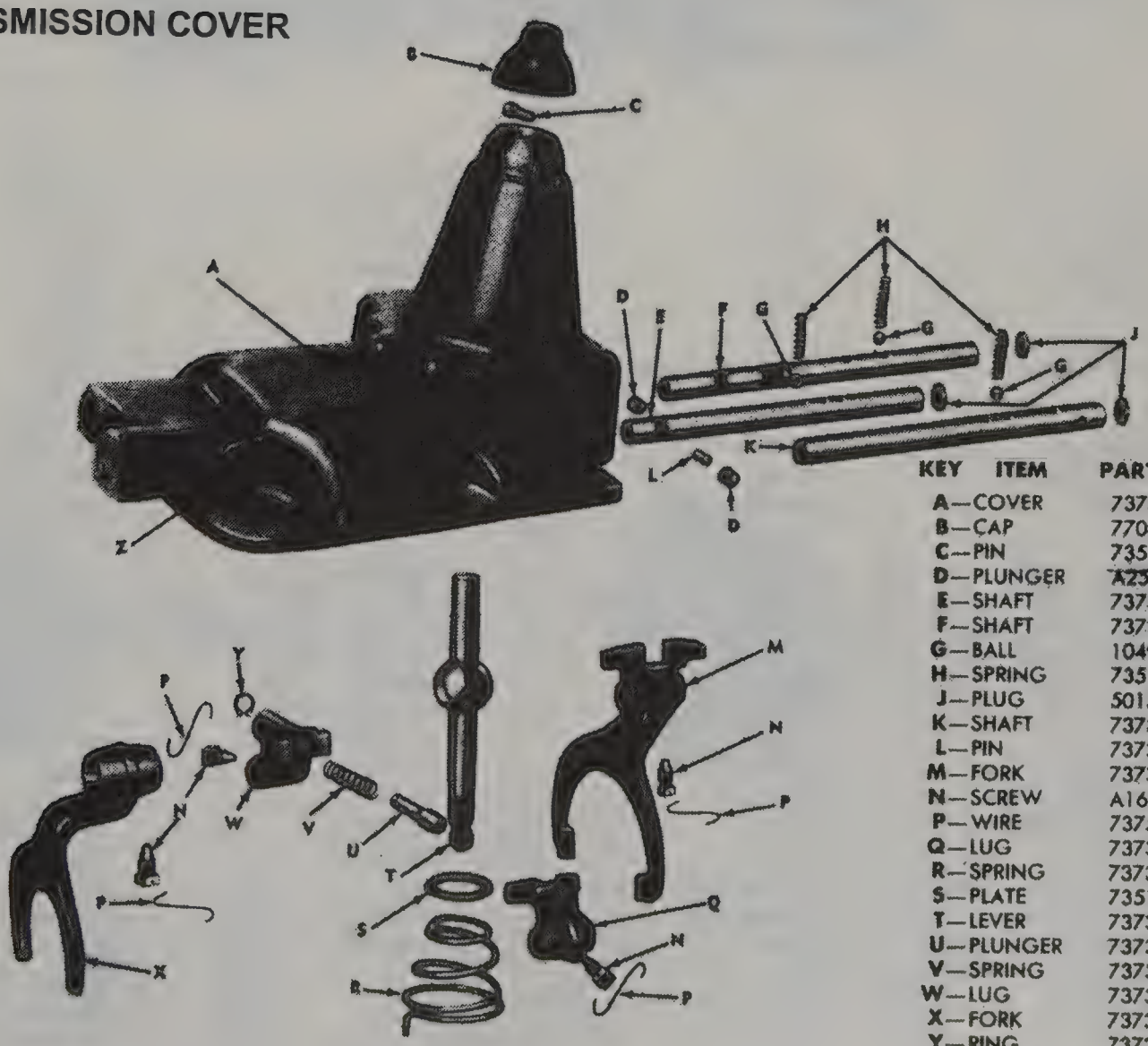
RA PD 355460

HEADLIGHT



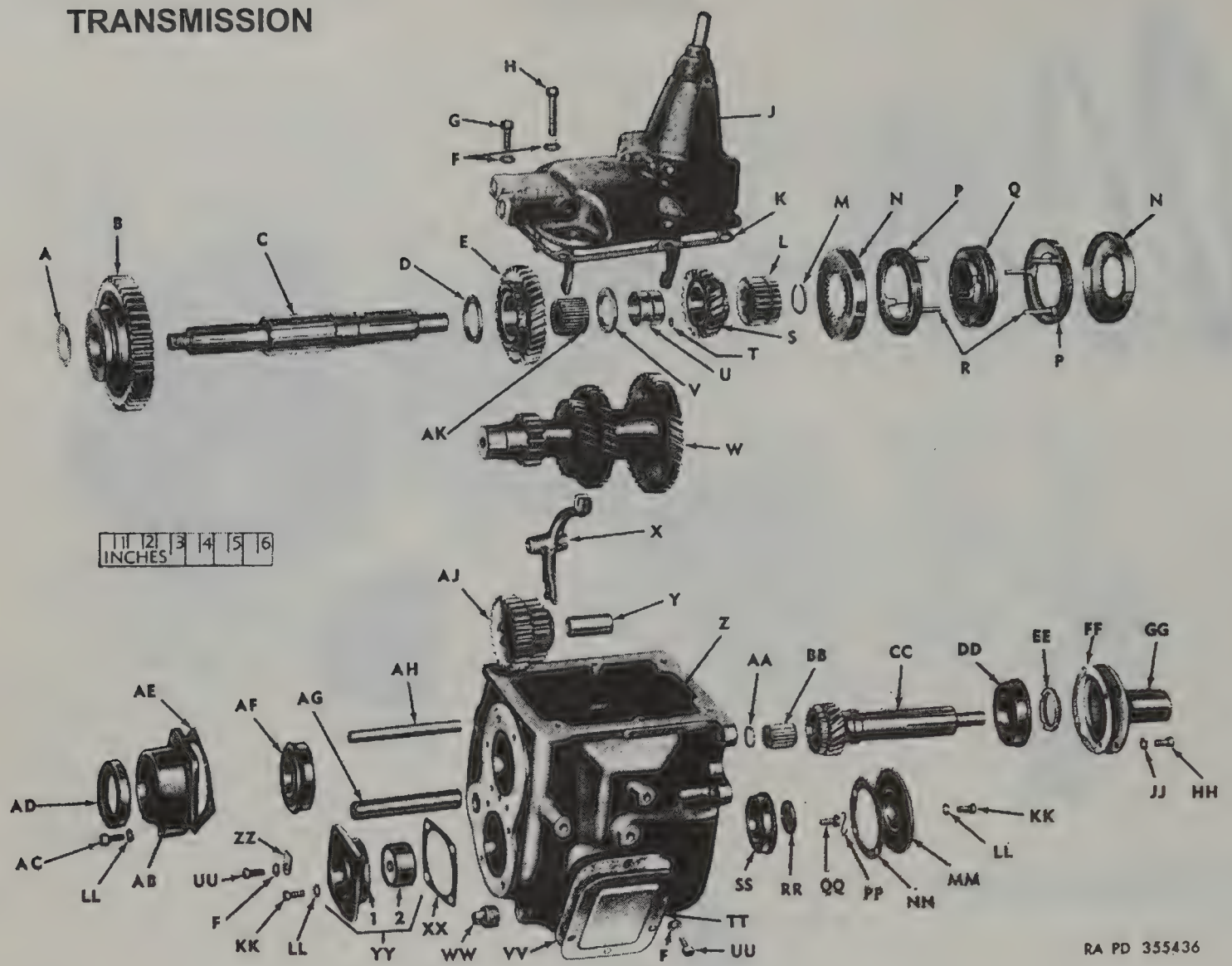
KEY	ITEM	PART NO	KEY	ITEM	PART NO
A	SCREW	AL-CB17770	M	TERMINAL	200011
B	DOOR	7353718	N	SCREW	120583
C	BOOT	AL-CB17766	P	BRACKET	7351354
D	CABLE, ASSY	AL-CB17423	Q	HARNESS, ASSY	AL-CB17443
E	SHELL	573007	R	WASHER	120380
F	GROMMET	573005	S	NUT	120375
G	TERMINAL	572929	T	GROMMET	7525365
H	BUSHING	572999	U	LAMP UNIT	AL-CB17419
J	SHELL	573010	V	RETAINER	AL-CB17768
K	BODY	AL-CB17435	W	RING	AL-CB17363
L	SLEEVE	573000			

TRANSMISSION COVER



KEY	ITEM	PART NO
A	COVER	7373624
B	CAP	7703037
C	PIN	7351048
D	PLUNGER	A230608
E	SHAFT	7373638
F	SHAFT	7373639
G	BALL	104920
H	SPRING	7351052
J	PLUG	501593
K	SHAFT	7373637
L	PIN	7373633
M	FORK	7373626
N	SCREW	A167457
P	WIRE	7375412
Q	LUG	7373631
R	SPRING	7373687
S	PLATE	7351049
T	LEVER	7373630
U	PLUNGER	7373634
V	SPRING	7373688
W	LUG	7373632
X	FORK	7373625
Y	RING	7373636
Z	PLUG	7373635

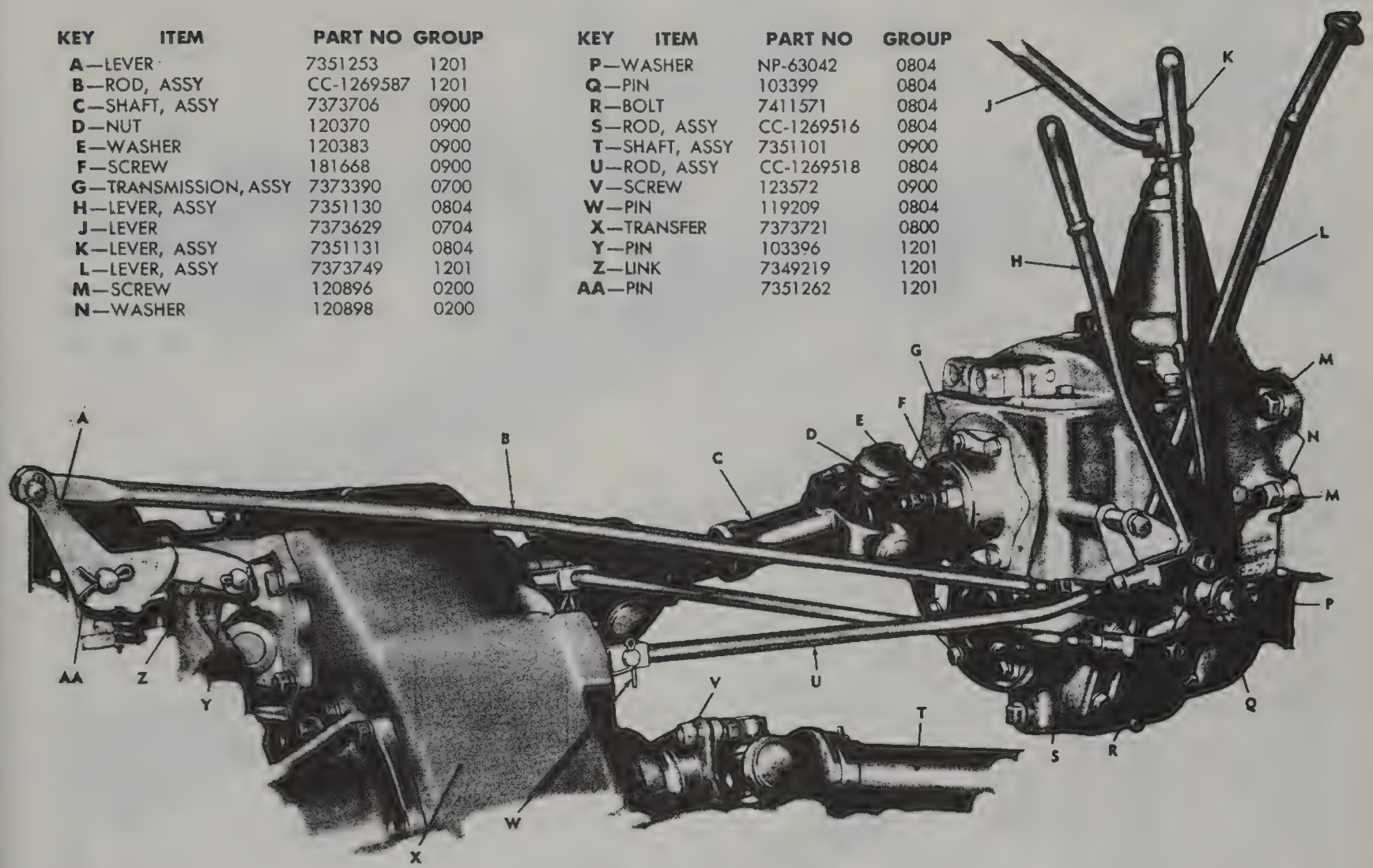
TRANSMISSION



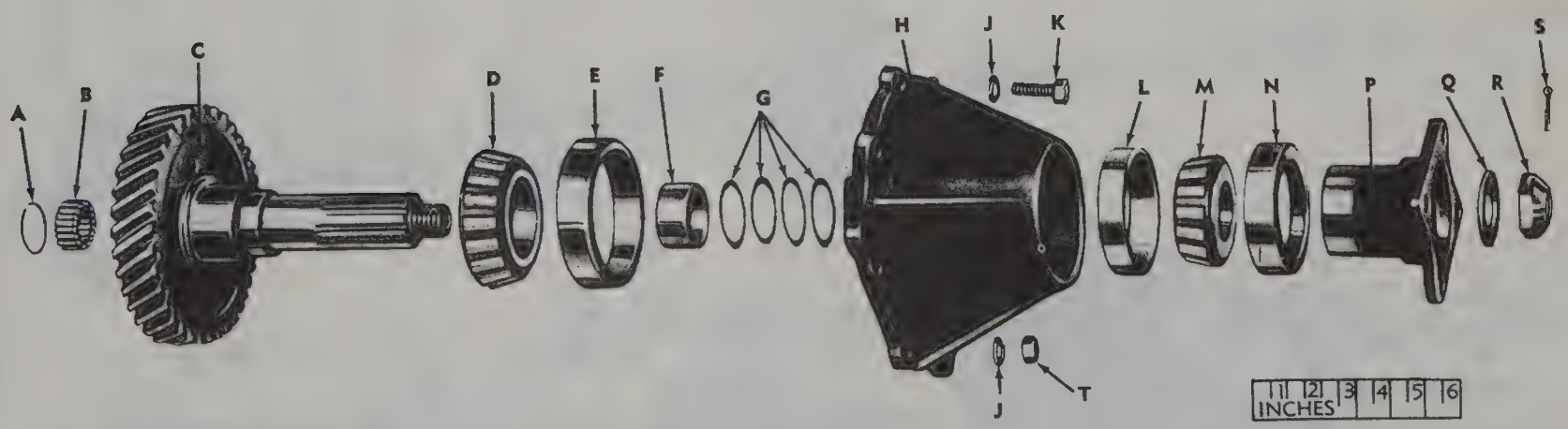
Key	Item	Part No.
A	— SHIM	7373609
B	— GEAR	7373397
C	— SHAFT	7373608
D	— WASHER	7373613
E	— GEAR	7373398
F	— WASHER	120382
G	— SCREW	122126
H	— SCREW	180129
J	— COVER, ASSY	7374901
K	— GASKET	7373628
L	— GEAR	NP-89067
M	— RING	7373603
N	— RING	NP-88382
P	— RING	NP-88384
Q	— CLUTCH	NP-89068
R	— PIN	NP-88477
S	— GEAR	7351266
T	— PIN	7373601
U	— BEARING	7373395
V	— WASHER	7373614
W	— COUNTERSHAFT	7373619
X	— FORK	7373627
Y	— BEARING	7373615
Z	— CASE	NP-88671
AA	— SPACER	7373611
BB	— BEARING	708267
CC	— SHAFT	7373391
DD	— BEARING	NP-68160
EE	— NUT	7373392
FF	— GASKET	7373393
GG	— RETAINER	7373394
HH	— SCREW	122007
JJ	— WASHER	138485
KK	— SCREW	120229
LL	— WASHER	120214
MM	— RETAINER	7373616
NN	— GASKET	7373617
PP	— WIRE	NP-38862
QQ	— SCREW	NP-88092
RR	— WASHER	7373621
SS	— BEARING	700952
TT	— COVER	7411910
UU	— SCREW	122119
VV	— GASKET	A214787
WW	— PLUG	7374954
XX	— GASKET	7373618
YY	— BEARING, ASSY	7373622
	1—RETAINER	NP-88256
	2—BEARING	708266
ZZ	— PLATE	7373620
AB	— RETAINER	NP-88528
AC	— SCREW	122017
AD	— SEAL	500134
AE	— GASKET	7373396
AF	— BEARING	700909
AG	— SHAFT	7373623
AH	— SHAFT	7373640
AJ	— GEAR	NP-88669
AK	— ROLLER	712390

TRANSFER CASE CONTROLS

KEY	ITEM	PART NO	GROUP
A	LEVER	7351253	1201
B	ROD, ASSY	CC-1269587	1201
C	SHAFT, ASSY	7373706	0900
D	NUT	120370	0900
E	WASHER	120383	0900
F	SCREW	181668	0900
G	TRANSMISSION, ASSY	7373390	0700
H	LEVER, ASSY	7351130	0804
J	LEVER	7373629	0704
K	LEVER, ASSY	7351131	0804
L	LEVER, ASSY	7373749	1201
M	SCREW	120896	0200
N	WASHER	120898	0200
P	WASHER	NP-63042	0804
Q	PIN	103399	0804
R	BOLT	7411571	0804
S	ROD, ASSY	CC-1269516	0804
T	SHAFT, ASSY	7351101	0900
U	ROD, ASSY	CC-1269518	0804
V	SCREW	123572	0900
W	PIN	119209	0804
X	TRANSFER	7373721	0800
Y	PIN	103396	1201
Z	LINK	7349219	1201
AA	PIN	7351262	1201

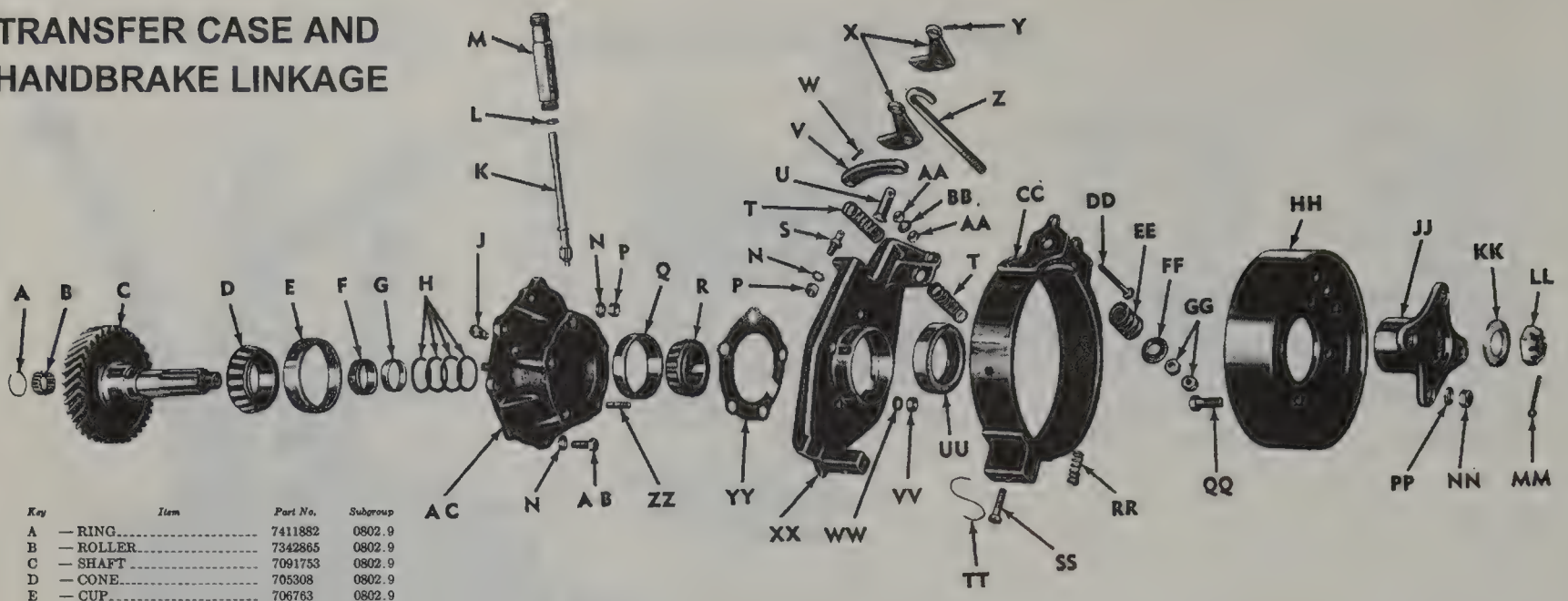


TRANSFER CASE (PARTIAL)



KEY	ITEM	PART NO	GROUP
A	RING	7411882	0802.7
B	ROLLERS	7342865	0802.7
C	SHAFT	7091753	0802.7
D	CONE	705308	0802.7
E	CLIP	706763	0802.7
F	SPACER	7342501	0802.7
G	SHIM	7342496	0802.7
H	RETAINER	NP-38537	0802.7
J	WASHER	120382	0802.7
K	SCREW	122138	0802.7
L	CUP	706746	0802.7
M	CONE	705268	0802.7
N	SEAL	7705744	0900
P	FLANGE	7373705	0900
Q	WASHER	7351153	0900
R	NUT	7743652	0900
S	PIN	119209	0900
T	NUT	120369	0802.7

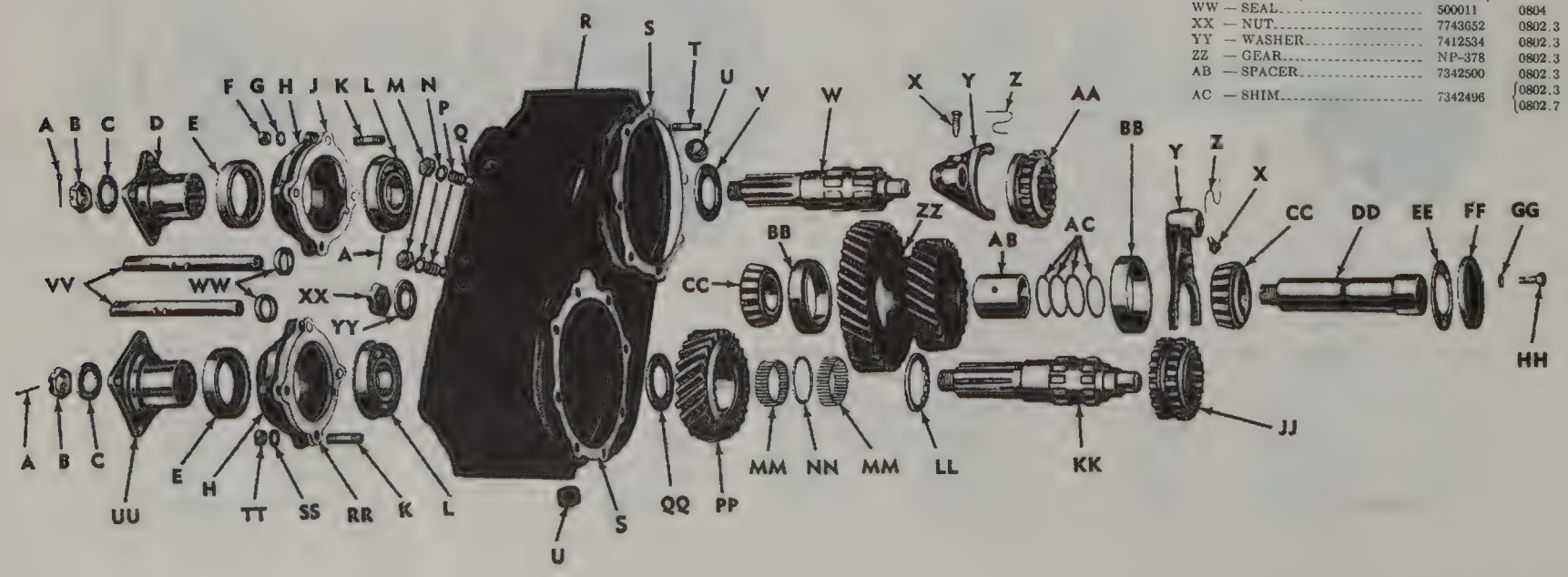
TRANSFER CASE AND HANDBRAKE LINKAGE



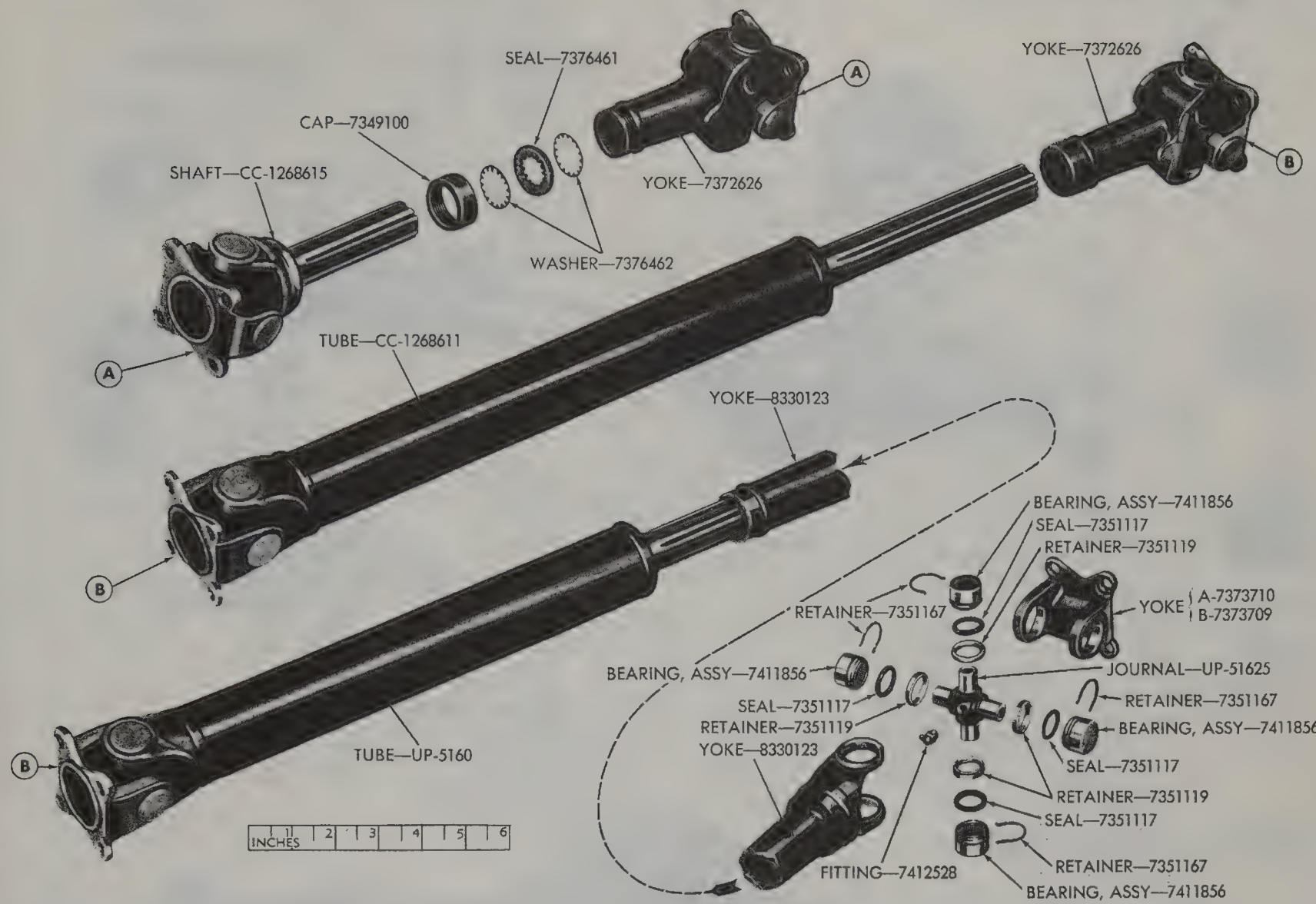
Key	Item	Part No.	Subgroup
A	— RING	7411882	0802.9
B	— ROLLER	7342865	0802.9
C	— SHAFT	7091753	0802.9
D	— CONE	705308	0802.9
E	— CUP	706763	0802.9
F	— GEAR	7411825	0802.9
G	— SPACER	7342499	0802.9
H	— SHIM	7342496	0802.9
J	— VENT, ASSY	A196397	0802.9
K	— PINION	7373732	0802.9
L	— SEAL	7411863	0802.9
M	— NUT	7373731	0802.9
N	— WASHER	120382	0802.9 1201
P	— NUT	120369	0802.9 1201
Q	— CUP	706746	0802.9
R	— CONE	705268	0802.9
S	— STUD	7411872	1201
T	— SPRING	5284008	1201
U	— PIN	7351262	1201
V	— LINK	7349219	1201
W	— PIN	103373	1201
X	— LEVER	7351253	1201
Y	— PIN	103396	1201
Z	— BOLT "J"	7705713	1201
AA	— NUT	120375	1201
BB	— WASHER	120380	1201
CC	— BAND, w/LINING, ASSY	7349062	1201
DD	— SCREW	NP-35775	1201
EE	— SPRING	6245692	1201
FF	— WASHER	120389	1201
GG	— NUT	124834	1201
HH	— DRUM	7349142	1201
JJ	— FLANGE	7351116	0900
KK	— WASHER	7351153	0900
LL	— NUT	7743652	0900
MM	— PIN	119209	0900
NN	— NUT	125913	1201
PP	— WASHER	138489	1201
QQ	— BOLT	7351254	1201
RR	— SPRING	7351256	1201
SS	— SCREW	7351258	1201
TT	— WIRE	CC-594682	0800
UU	— SEAL	7705744	0900
VV	— NUT	120369	1201
WW	— WASHER	120382	1201
XX	— SUPPORT	7411871	1201
YY	— GASKET	7373725	1201
ZZ	— STUD	113247	1201
AB	— SCREW	122138	0802.9
AC	— RETAINER	CC-927359	0802.9

Key	Item	Part No.	Subgroup
A	— PIN	119209	0802.3 0900
B	— NUT	7743652	0900
C	— WASHER	7351153	0900
D	— FLANGE	7373705	0900
E	— SEAL	7705744	0900
F	— NUT	120370	0802.5
G	— WASHER	120383	0802.5
H	— RETAINER	NP-38552	0802.1 0802.5
J	— GASKET	7412051	0802.5
K	— STUD	NP-37378	0802.1 0802.5
L	— BEARING	700792	0802.1 0802.5
M	— SCREW	7351129	0804
N	— GASKET	7373727	0804
P	— SPRING	7351126	0804
Q	— BALL	104919	0804
R	— CASE	NP-38631	0801
S	— GASKET	7411824	0802.7 0802.9
T	— STUD	113247	0802.7 0802.9
U	— PLUG	7374954	0801
V	— WASHER	7411881	0802.5
W	— SHAFT	7351134	0802.5
X	— SCREW	7411570	0804
Y	— FORK	7091754	0804
Z	— WIRE	7375412	0804
AA	— GEAR	7411880	0802.5
BB	— CUP	706746	0802.3
CC	— CONE	705268	0802.3
DD	— SHAFT	7342505	0802.3
EE	— GASKET	7411885	0802.3
FF	— COVER	7342649	0802.3
GG	— WASHER	120214	0802.3
HH	— SCREW	122007	0802.3
JJ	— GEAR	7412043	0802.1
KK	— SHAFT	7351062	0802.1
LL	— WASHER	7412046	0802.1
MM	— ROLLER	712398	0802.1
NN	— SPACER	7342723	0802.1
PP	— GEAR	7412044	0802.1
QQ	— WASHER	7411881	0802.1
RR	— GASKET	7411883	0802.1
SS	— WASHER	120383	0802.1
TT	— NUT	120370	0802.1
UU	— FLANGE	7373704	0900
VV	— SHAFT (two speed)	7342858	0804
	— SHAFT (input)	7342859	
WW	— SEAL	500011	0804
XX	— NUT	7743652	0802.3
YY	— WASHER	7412534	0802.3
ZZ	— GEAR	NP-378	0802.3
AB	— SPACER	7342500	0802.3
AC	— SHIM	7342496	0802.3 0802.7

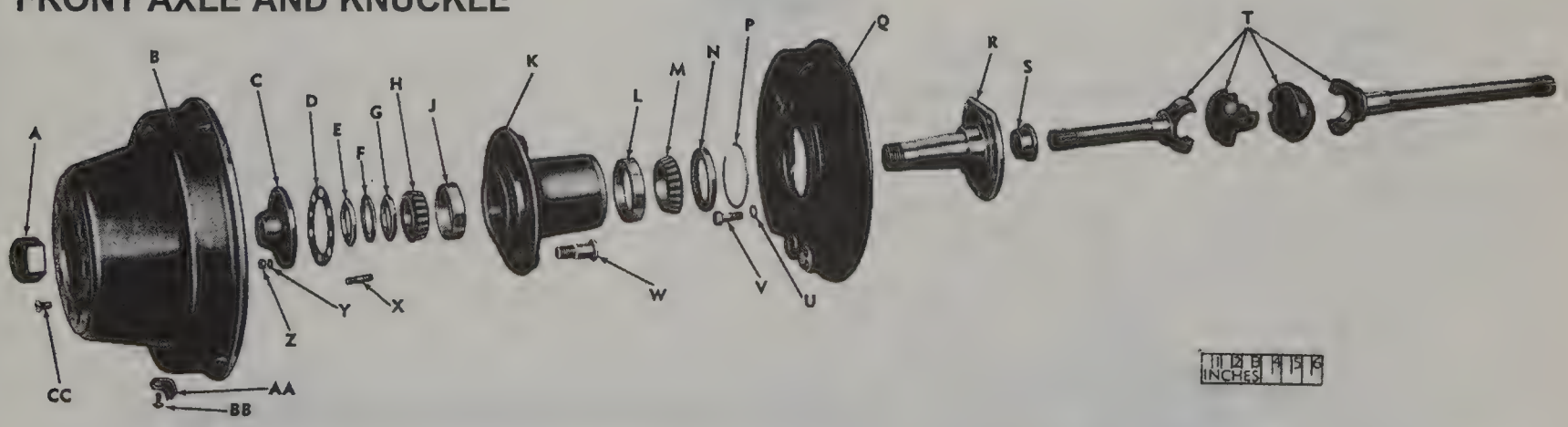
TRANSFER CASE (PARTIAL)



PROPELLER SHAFT AND U-JOINTS



FRONT AXLE AND KNUCKLE

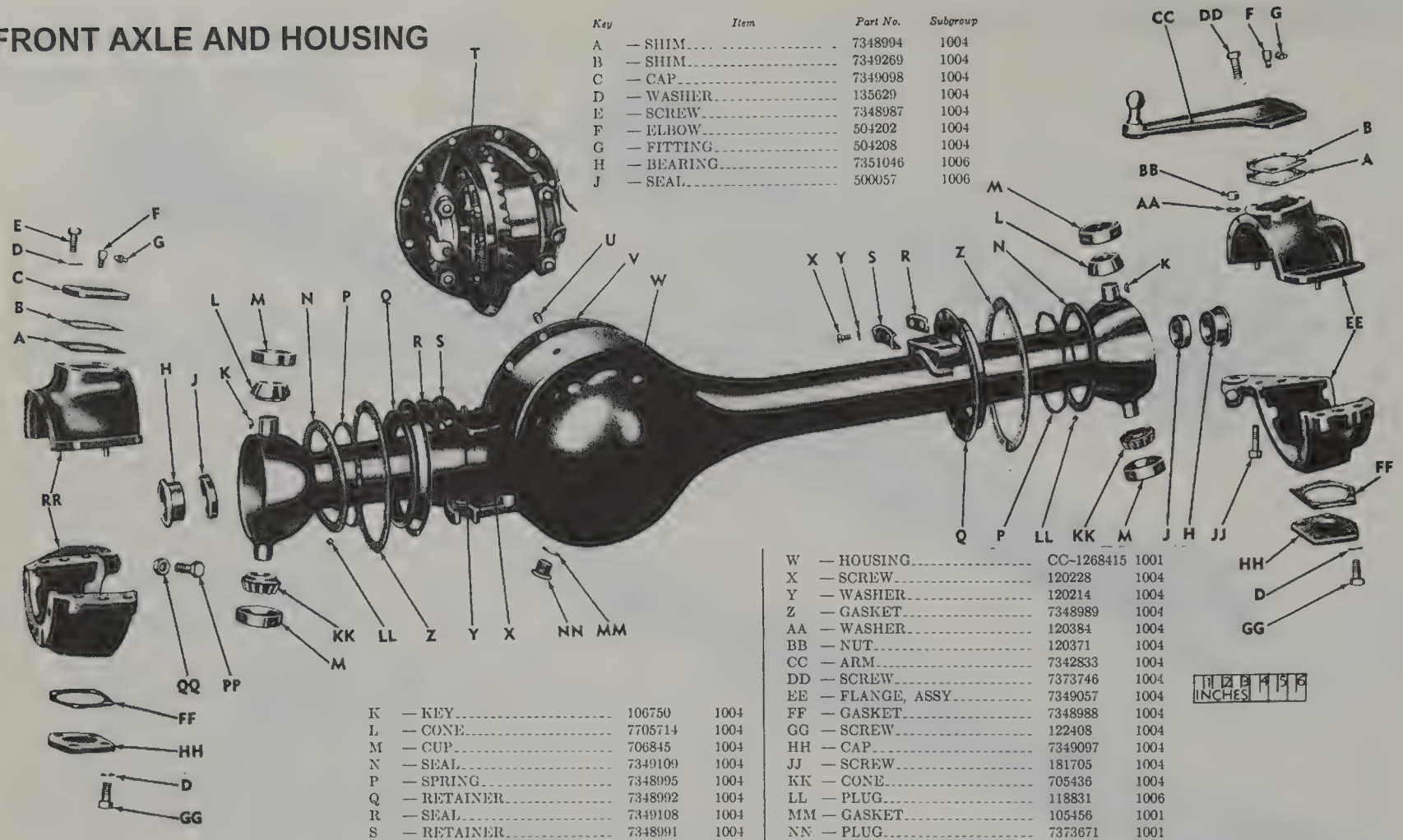


KEY	ITEM	PART NO	GROUP
A	NUT	537803	1311
B	DRUM	7705745	1311
C	FLANGE	7349059	1006
D	GASKET	7351041	1006
E	NUT	7348981	1311
F	LOCK	7349223	1311
G	NUT, ASSY	7348977	1311
H	CONE	705277	1311
J	CUP	706751	1311

KEY	ITEM	PART NO	GROUP
K	HUB	BW-45425D	1311
L	CUP	706873	1311
M	CONE	705472	1311
N	SEAL	500174	1311
P	RING	7348984	1311
Q	SUPPORT, LEFT, ASSY	CC-1265137	1202
R	KNUCKLE, ASSY	7348990	1004
S	BEARING	7351046	1006
T	DRIVE, LEFT, ASSY	7373748	1006

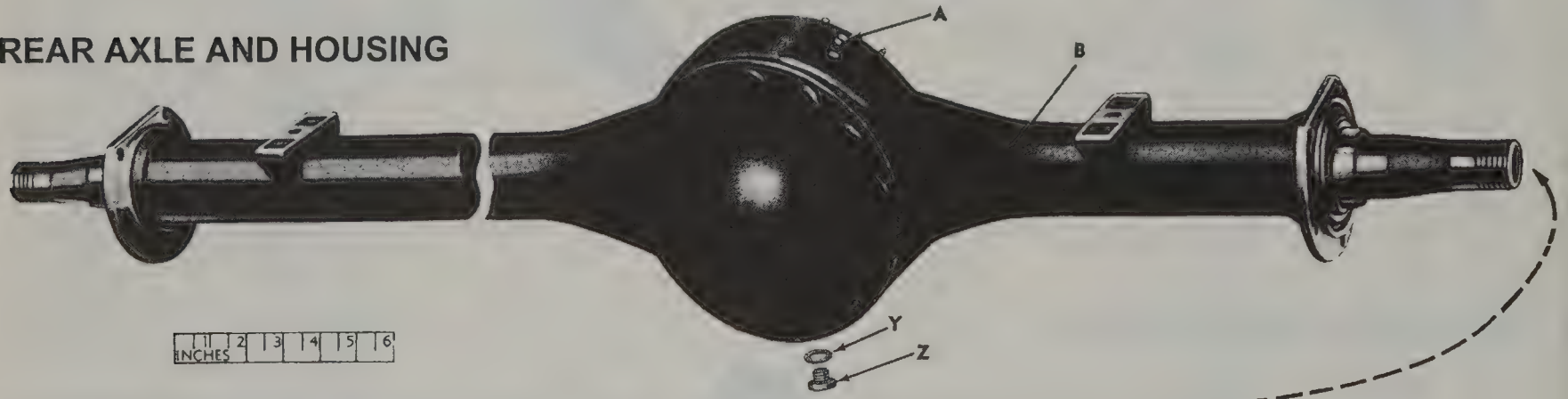
KEY	ITEM	PART NO	GROUP
U	WASHER	120384	1004
V	SCREW	122433	1004
W	STUD	501826	1311
X	STUD	7351088	1006
Y	WASHER	120382	1006
Z	NUT	125913	1006
AA	COVER	7342413	1311
BB	SCREW	131375	1311
CC	SCREW	133906	1311

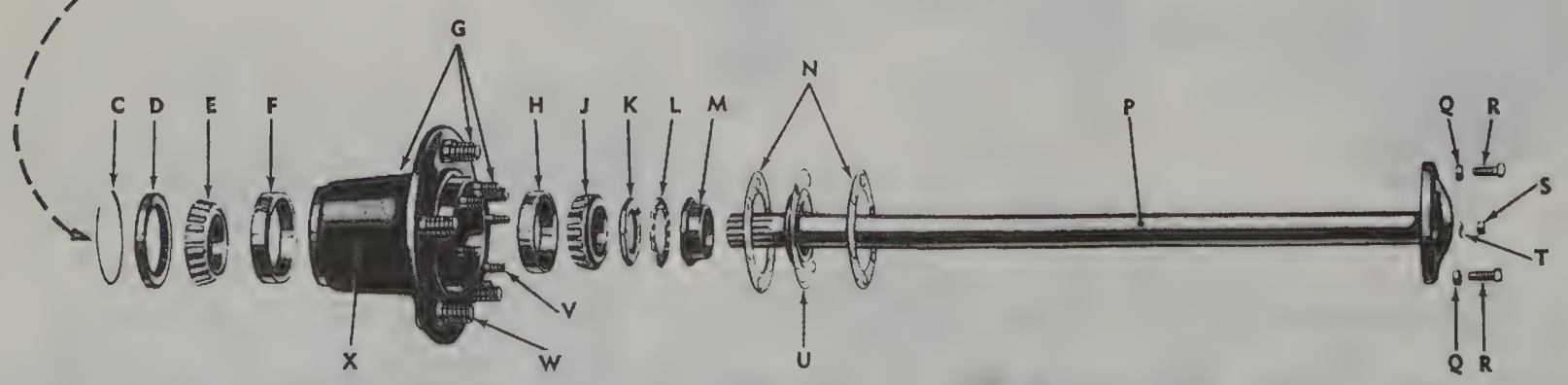
FRONT AXLE AND HOUSING



Key	Item	Part No.	Subgroup
A	— SHIM	7348994	1004
B	— SHIM	7349269	1004
C	— CAP	7349098	1004
D	— WASHER	135629	1004
E	— SCREW	7348987	1004
F	— ELBOW	504202	1004
G	— FITTING	504208	1004
H	— BEARING	7351046	1006
J	— SEAL	500057	1006
K	— KEY	106750	1004
L	— CONE	7705714	1004
M	— CUP	706845	1004
N	— SEAL	7349109	1004
P	— SPRING	7348995	1004
Q	— RETAINER	7348992	1004
R	— SEAL	7349108	1004
S	— RETAINER	7348991	1004
T	— DIFFERENTIAL, ASSY	7373714	1002
U	— VENT	5196397	1001
V	— GASKET	7411818	1002
W	— HOUSING	CC-1268415	1001
X	— SCREW	120228	1004
Y	— WASHER	120214	1004
Z	— GASKET	7348989	1004
AA	— WASHER	120384	1004
BB	— NUT	120371	1004
CC	— ARM	7342833	1004
DD	— SCREW	7373746	1004
EE	— FLANGE, ASSY	7349057	1004
FF	— GASKET	7348988	1004
GG	— SCREW	122408	1004
HH	— CAP	7349097	1004
JJ	— SCREW	181705	1004
KK	— CONE	705436	1004
LL	— PLUG	118831	1006
MM	— GASKET	105456	1001
NN	— PLUG	7373671	1001
PP	— SCREW	7348993	1004
QQ	— NUT	124573	1004
RR	— FLANGE, ASSY	7349056	1004

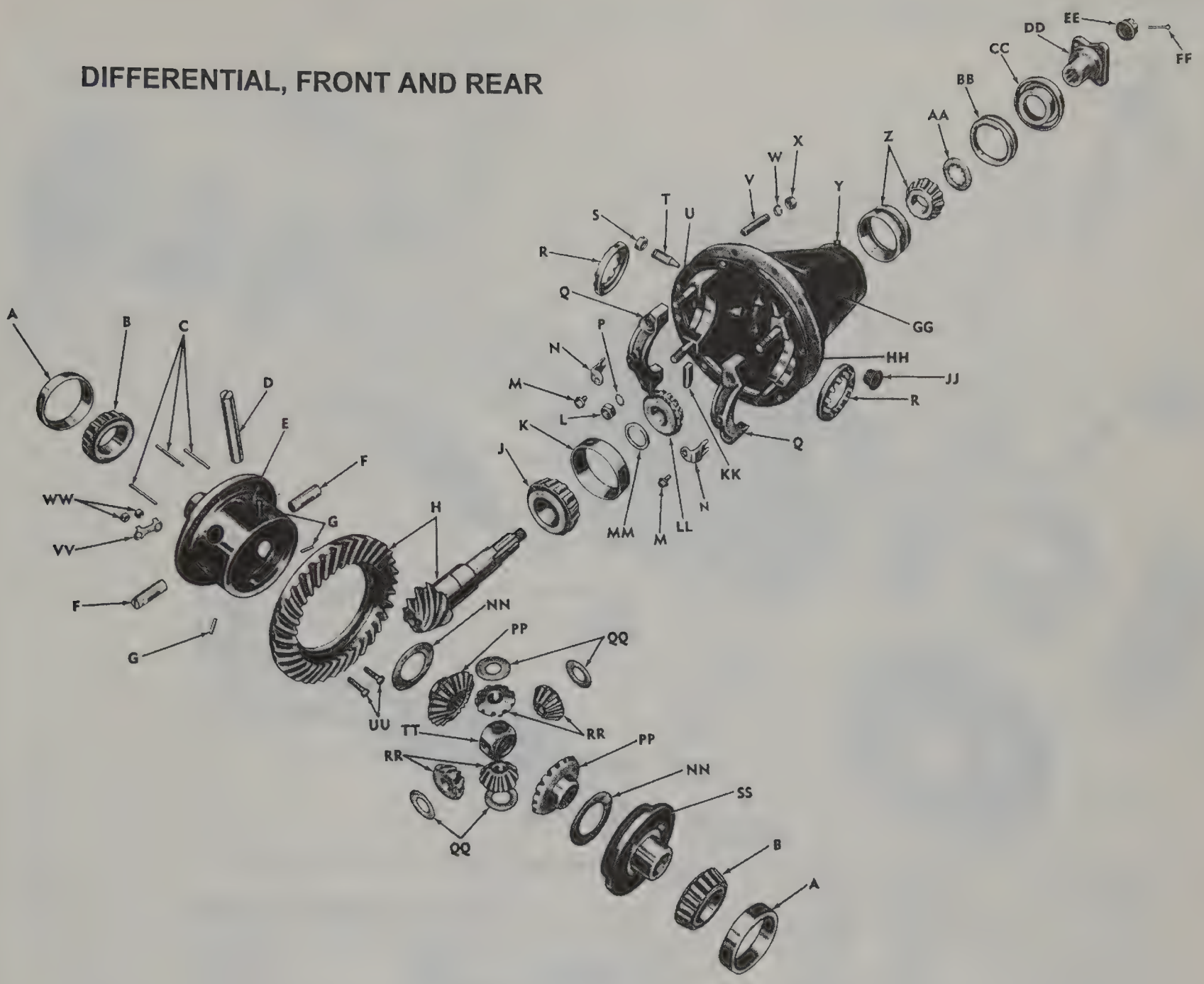
REAR AXLE AND HOUSING





KEY	ITEM	PART NO	GROUP
A	—VENT	7351087	1101
B	—HOUSING, ASSY	7373712	1101
C	—RING	7348984	1311
D	—SEAL	500174	1311
E	—CONE	705472	1311
F	—CUP	706873	1311
G	—HUB, ASSY	7349048	1311
H	—CUP	706751	1311
J	—CONE	705277	1311
K	—NUT, ASSY	7348977	1311
L	—LOCK	7349223	1311
M	—NUT	7348982	1311
N	—GASKET	7351041	1104.1
P	—SHAFT	7373717	1104.1
Q	—NUT	134566	1104.1
R	—SCREW	134581	1104.1
S	—NUT	125913	1104.1
T	—WASHER	120382	1104.1
U	—SEAL	500125	1311
V	—STUD	7351088	1104.1
W	—STUD	501826	1311
X	—HUB	BW-45425D	1311
Y	—GASKET	105456	1101
Z	—PLUG	7373671	1101

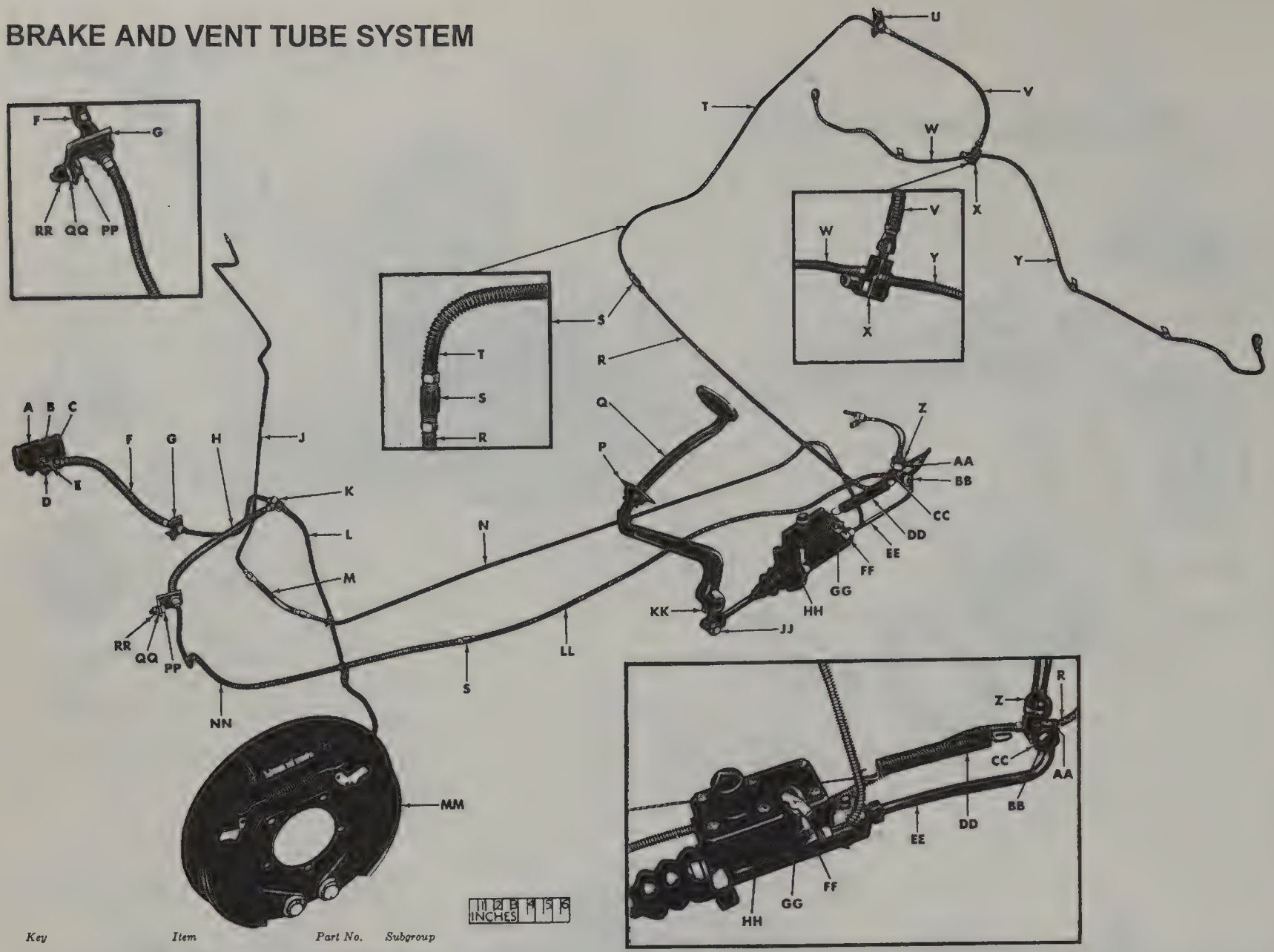
DIFFERENTIAL, FRONT AND REAR



Key	*Item*	*Part No.*
A	— CUP	706880
B	— CONE	705776
C	— PIN	144563
D	— SHAFT	7349237
E	— CASE (serviced in CASE w/CAP, assy 7342845)	Not Serviced
F	— SHAFT	7342576
G	— PIN	141211
H	— GEAR SET	7411946
J	— CONE	705539
K	— CUP	706922
L	— NUT	121358
M	— SCREW, ASSY	CC–1125444
N	— LOCK	7349071
P	— WASHER	138502
Q	— CAP (serviced in CARRIER, w/CAP, assy (CC–926239)	Not Serviced
R	— NUT	7411820
S	— NUT	7372624
T	— SCREW	7372623
U	— STUD	7411918
V	— STUD	7411817
W	— WASHER	120383
X	— NUT	7378194
Y	— SCREW	102883

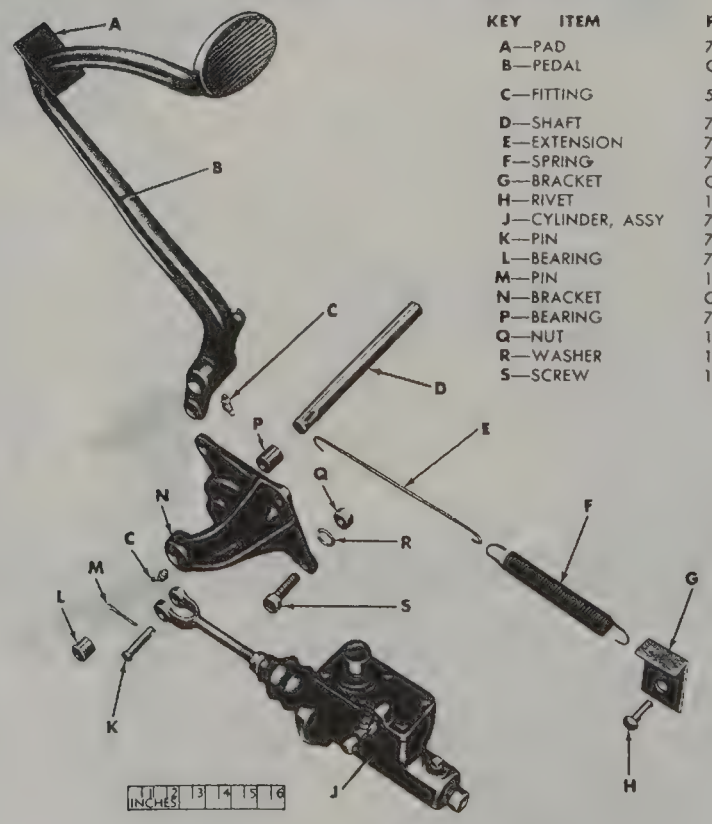
Key	*Item*	*Part No.*
Z	— BEARING, ASSY	703190
AA	— WASHER	7351141
BB	— NUT	7411821
CC	— SEAL	7411822
DD	— FLANGE	7373715
EE	— NUT	7411915
FF	— PIN	119209
GG	— CARRIER (serviced in CARRIER w/CAP, assy CC–926239)	Not Serviced
HH	— GASKET	7411818
JJ	— PLUG	7374954
KK	— PAD	7351149
LL	— CONE (serviced in BEARING, assy 703190)	Not Serviced
MM	— SPACER	7351150
NN	— WASHER	7411949
PP	— GEAR	7411919
QQ	— WASHER	7411948
RR	— PINION	7411947
SS	— CAP (serviced in CASE, w/CAP, assy 7342845)	Not Serviced
TT	— BLOCK	7342417
UU	— BOLT	7351309
VV	— LOCK	7349072
WW	— NUT	8328203

BRAKE AND VENT TUBE SYSTEM



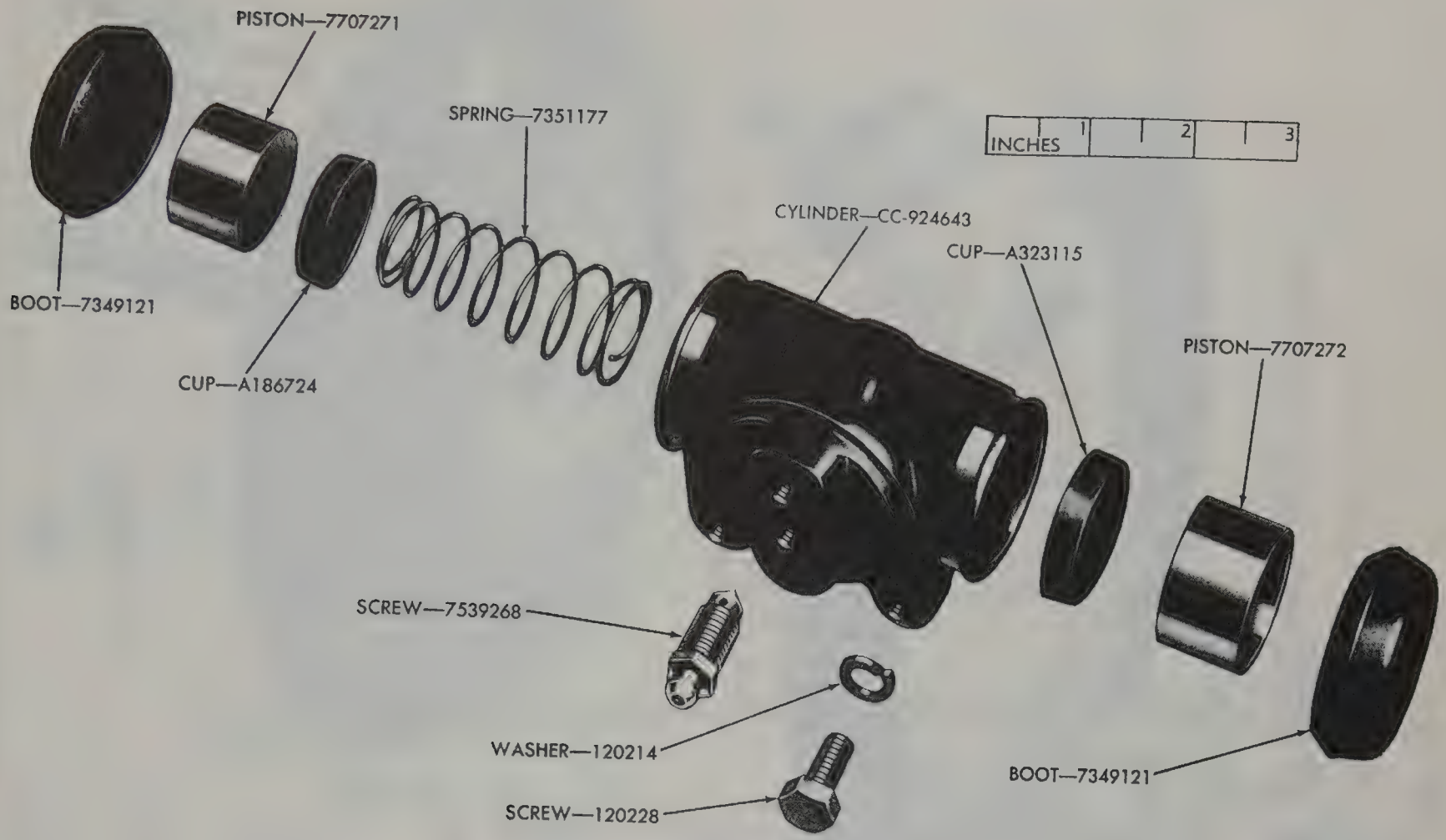
Key	Item	Part No.	Subgroup
A	— CYLINDER, ASSY	CC-1271436	1204.3
B	— SCREW	7539268	1204.3
C	— CONNECTION	A323092	1204.3
D	— BOLT	CC-79193	1204.3
E	— GASKET	7745466	1204.3
F	— LINE	7338963	1204.5
G	— BRACKET	CC-921949	1204.5
H	— LINE, ASSY	CC-1268696	1204.5
J	— LINE, ASSY	CC-1274915	0304.2
K	— TEE	7351215	1204.5
L	— LINE, ASSY	CC-1268697	1204.5
M	— LINE	8327963	0304.2
N	— LINE, ASSY	CC-1272549	0304.2
P	— PAD	7351174	1206
Q	— PEDAL	CC-1269591	1206
R	— LINE, ASSY	CC-1268700	1204.5
S	— UNION	137413	1204.5
T	— LINE, ASSY	CC-1268701	1204.5
U	— BRACKET	CC-920687	1204.5
V	— LINE	7351304	1204.5
W	— LINE, ASSY	CC-1268694	1204.5
X	— TEE	7351301	1204.5
Y	— LINE, ASSY	CC-1268695	1204.5
Z	— SWITCH, ASSY	7388813	0608
AA	— WASHER	138506	1204.5
BB	— NUT	124949	1204.5
CC	— TEE	7745692	1204.5
DD	— SPRING	7351089	1206
EE	— LINE, ASSY	CC-1268703	1204.5
FF	— ELBOW	137420	0304.2
GG	— COCK	189839	0304.2
HH	— CYLINDER, ASSY	7373718	1204.1
JJ	— PIN	7413181	1204.1
KK	— FITTING	504205	1206
LL	— LINE, ASSY	CC-1272531	1204.5
MM	— SUPPORT, ASSY	CC-1265137	1202
NN	— LINE, ASSY	CC-1268699	1204.5
PP	— STUD	149510	1204.5
QQ	— WASHER	120382	1204.5
RR	— NUT	120369	1204.5

BRAKE PEDAL LINKAGE



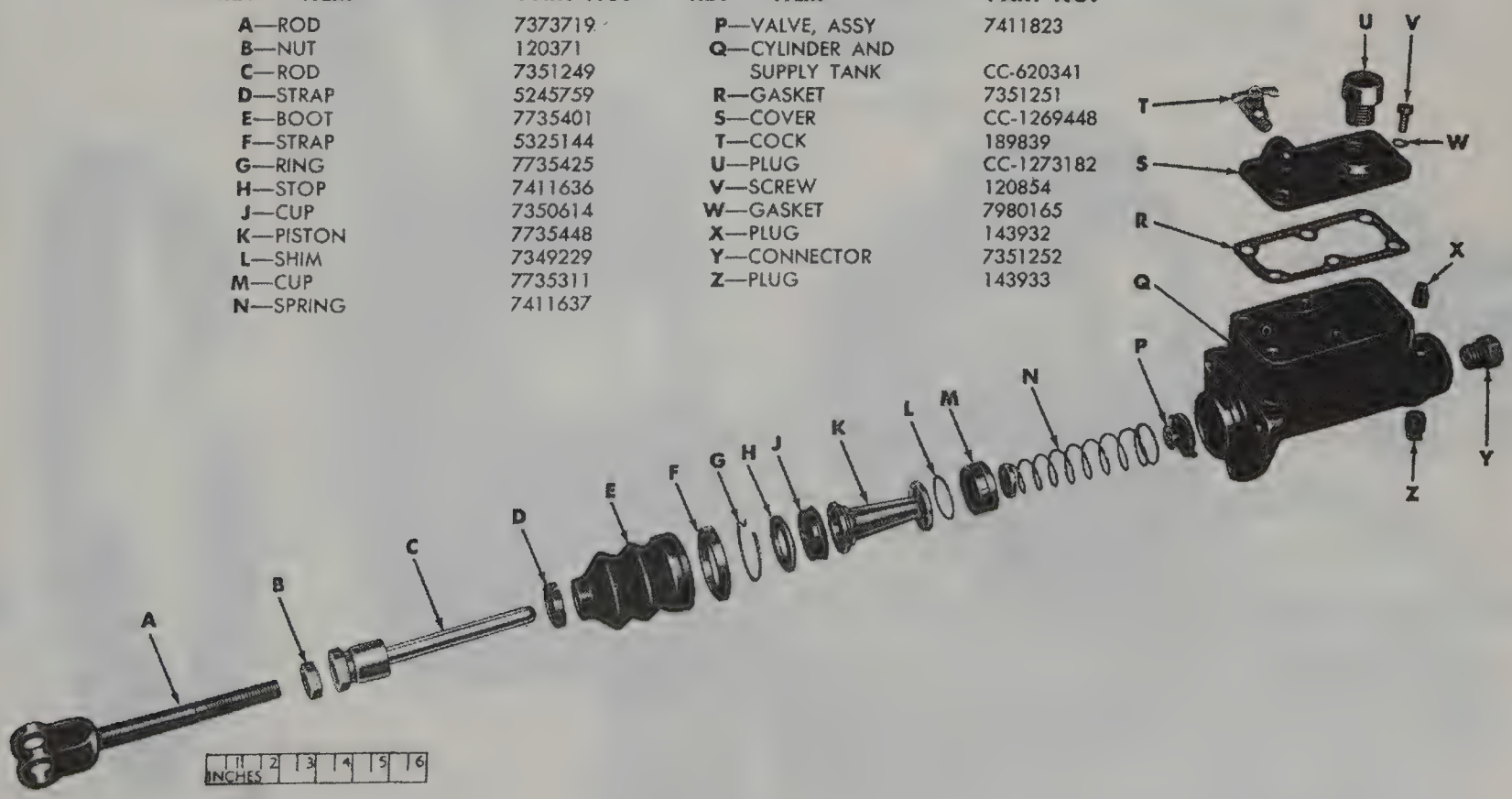
KEY	ITEM	PART NO.
A	—PAD	7351174
B	—PEDAL	CC-1269591
C	—FITTING	504205
D	—SHAFT	7373667
E	—EXTENSION	7373782
F	—SPRING	7351089
G	—BRACKET	CC-1269606
H	—RIVET	104113
J	—CYLINDER, ASSY	7373718
K	—PIN	7413181
L	—BEARING	7373659
M	—PIN	108630
N	—BRACKET	CC-1269594
P	—BEARING	7369887
Q	—NUT	120371
R	—WASHER	120384
S	—SCREW	120234

WHEEL CYLINDER

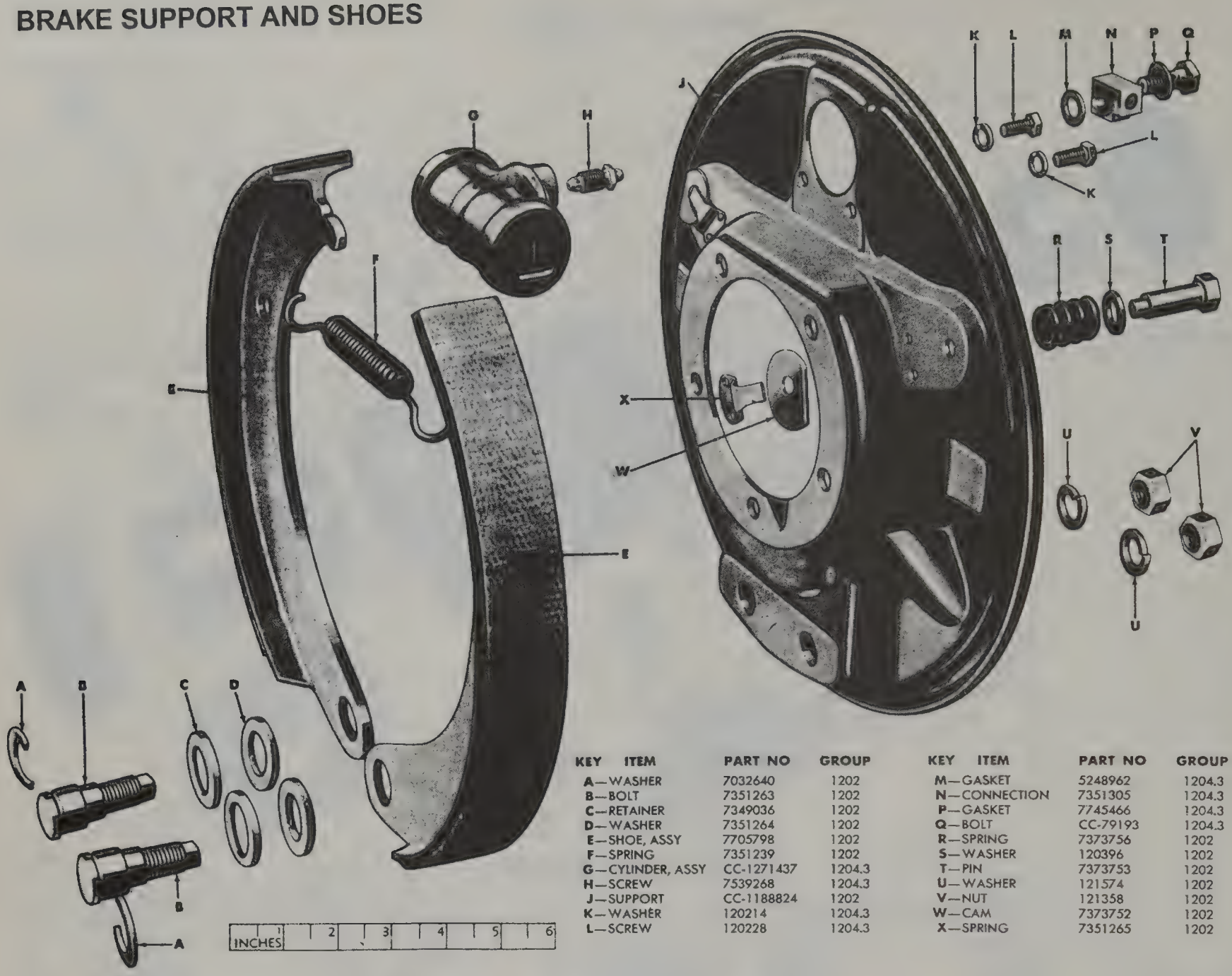


MASTER CYLINDER

KEY	ITEM	PART NO.
A	ROD	7373719
B	NUT	120371
C	ROD	7351249
D	STRAP	5245759
E	BOOT	7735401
F	STRAP	5325144
G	RING	7735425
H	STOP	7411636
J	CUP	7350614
K	PISTON	7735448
L	SHIM	7349229
M	CUP	7735311
N	SPRING	7411637
P	VALVE, ASSY	7411823
Q	CYLINDER AND SUPPLY TANK	CC-620341
R	GASKET	7351251
S	COVER	CC-1269448
T	COCK	189839
U	PLUG	CC-1273182
V	SCREW	120854
W	GASKET	7980165
X	PLUG	143932
Y	CONNECTOR	7351252
Z	PLUG	143933

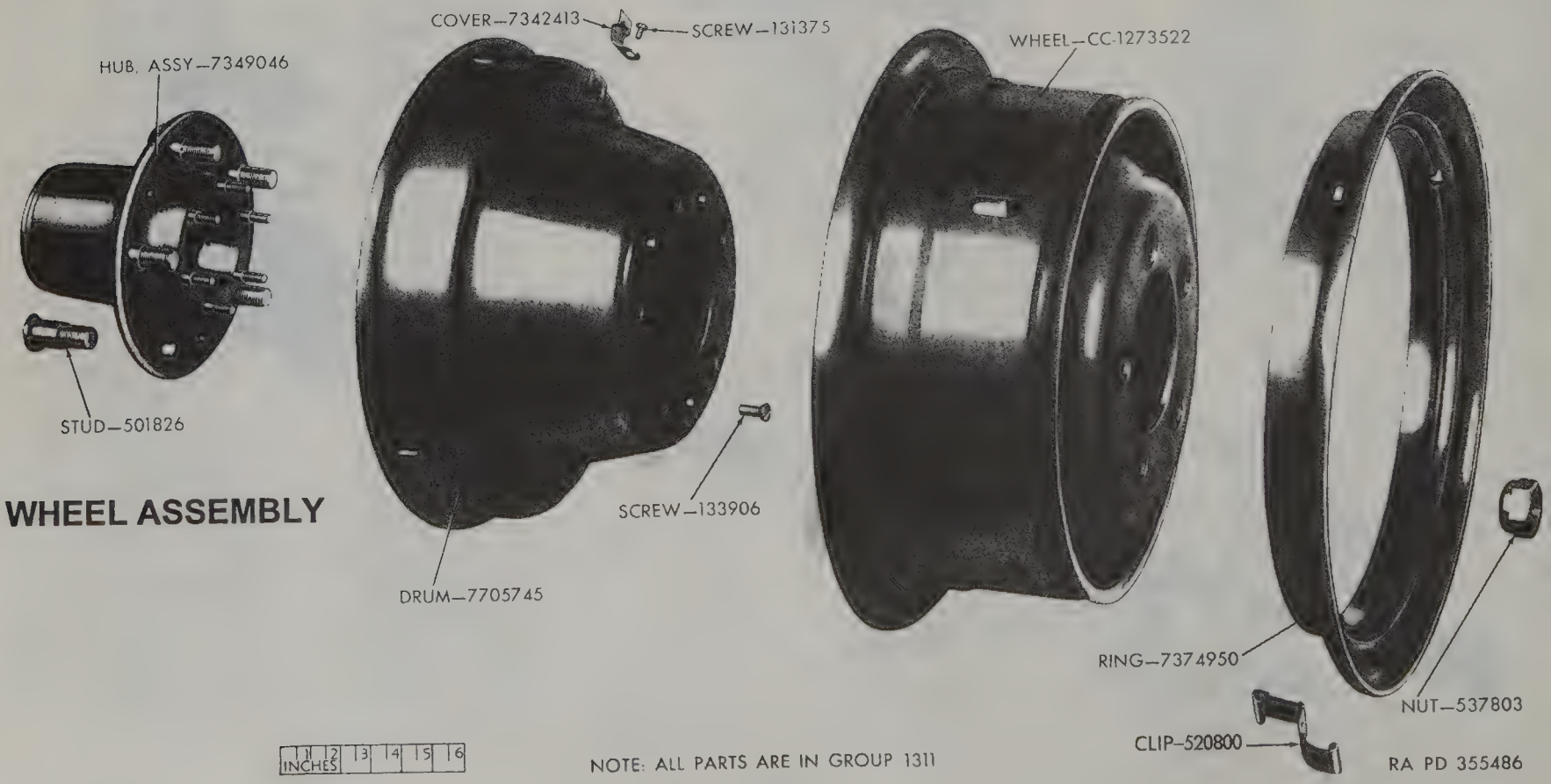


BRAKE SUPPORT AND SHOES



KEY	ITEM	PART NO	GROUP	KEY	ITEM	PART NO	GROUP
A	WASHER	7032640	1202	M	GASKET	5248962	1204.3
B	BOLT	7351263	1202	N	CONNECTION	7351305	1204.3
C	RETAINER	7349036	1202	P	GASKET	7745466	1204.3
D	WASHER	7351264	1202	Q	BOLT	CC-79193	1204.3
E	SHOE, ASSY	7705798	1202	R	SPRING	7373756	1202
F	SPRING	7351239	1202	S	WASHER	120396	1202
G	CYLINDER, ASSY	CC-1271437	1204.3	T	PIN	7373753	1202
H	SCREW	7539268	1204.3	U	WASHER	121574	1202
J	SUPPORT	CC-1188824	1202	V	NUT	121358	1202
K	WASHER	120214	1204.3	W	CAM	7373752	1202
L	SCREW	120228	1204.3	X	SPRING	7351265	1202

WHEEL ASSEMBLY

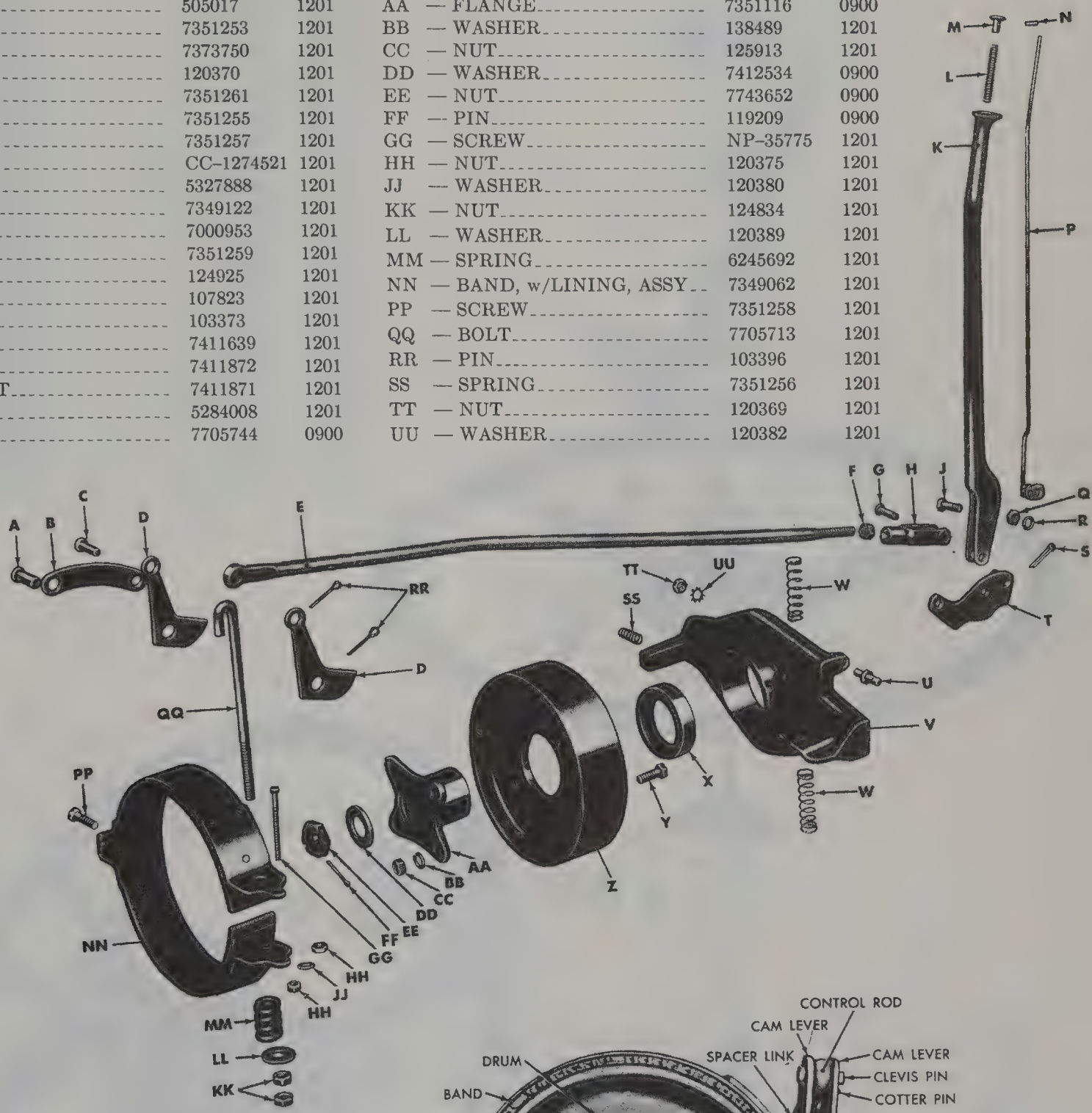


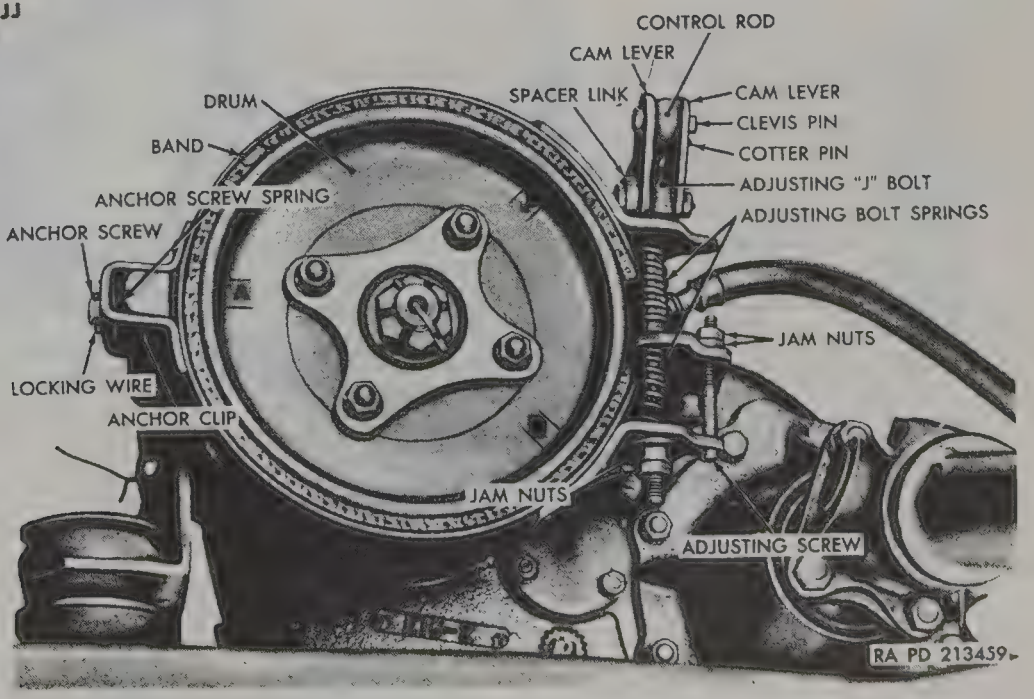
NOTE: ALL PARTS ARE IN GROUP 1311

RA PD 355486

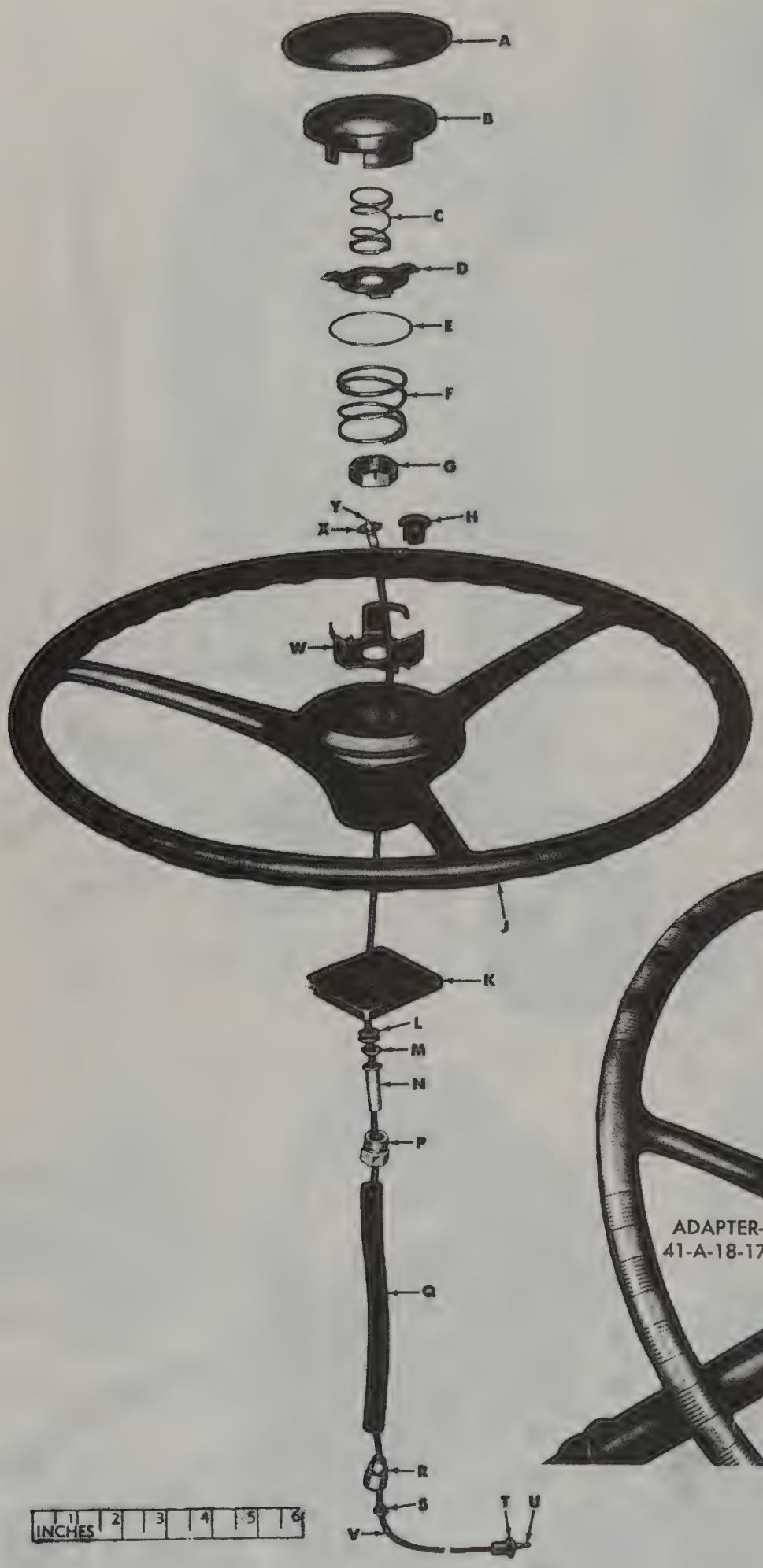
HAND BRAKE SYSTEM

Key	Item	Part No.	Subgroup
A	— PIN	7351262	1201
B	— LINK	7349219	1201
C	— PIN	505017	1201
D	— LEVER	7351253	1201
E	— ROD	7373750	1201
F	— NUT	120370	1201
G	— PIN	7351261	1201
H	— YOKE	7351255	1201
J	— BOLT	7351257	1201
K	— LEVER	CC–1274521	1201
L	— SPRING	5327888	1201
M	— BUTTON	7349122	1201
N	— PIN	7000953	1201
P	— ROD	7351259	1201
Q	— NUT	124925	1201
R	— NUT	107823	1201
S	— PIN	103373	1201
T	— SECTOR	7411639	1201
U	— STUD	7411872	1201
V	— SUPPORT	7411871	1201
W	— SPRING	5284008	1201
X	— SEAL	7705744	0900
Y	— BOLT	7351254	1201
Z	— DRUM	7349142	1201
AA	— FLANGE	7351116	0900
BB	— WASHER	138489	1201
CC	— NUT	125913	1201
DD	— WASHER	7412534	0900
EE	— NUT	7743652	0900
FF	— PIN	119209	0900
GG	— SCREW	NP–35775	1201
HH	— NUT	120375	1201
JJ	— WASHER	120380	1201
KK	— NUT	124834	1201
LL	— WASHER	120389	1201
MM	— SPRING	6245692	1201
NN	— BAND, w/LINING, ASSY	7349062	1201
PP	— SCREW	7351258	1201
QQ	— BOLT	7705713	1201
RR	— PIN	103396	1201
SS	— SPRING	7351256	1201
TT	— NUT	120369	1201
UU	— WASHER	120382	1201

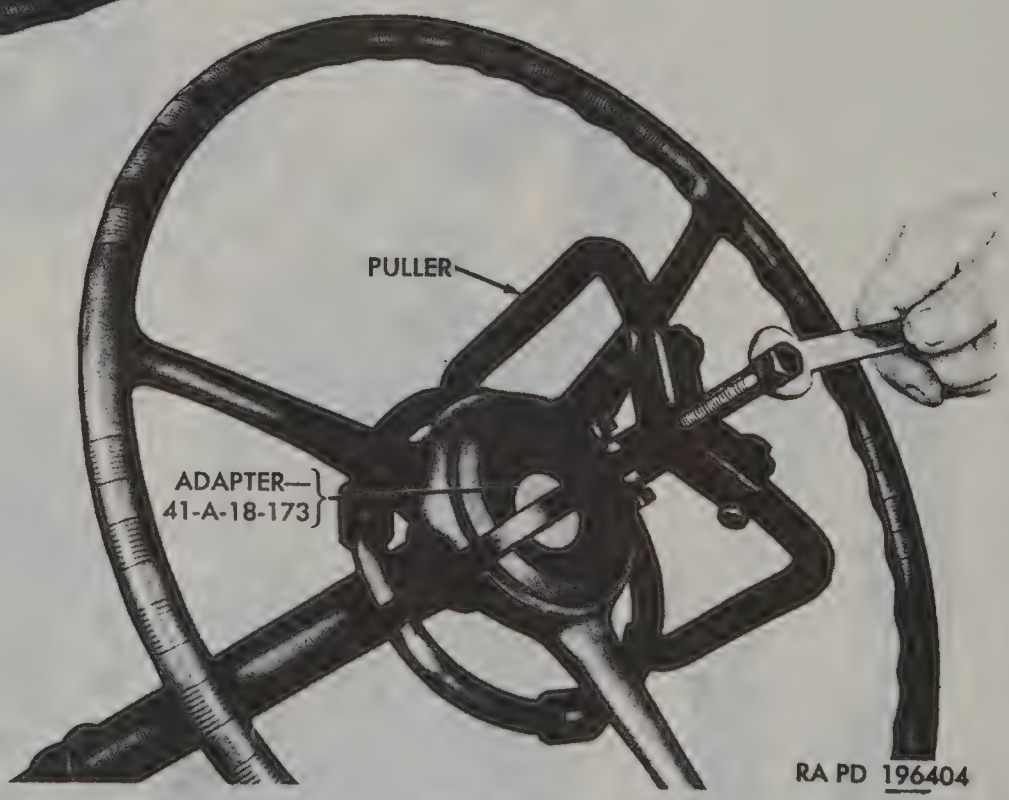




STEERING WHEEL AND HORN



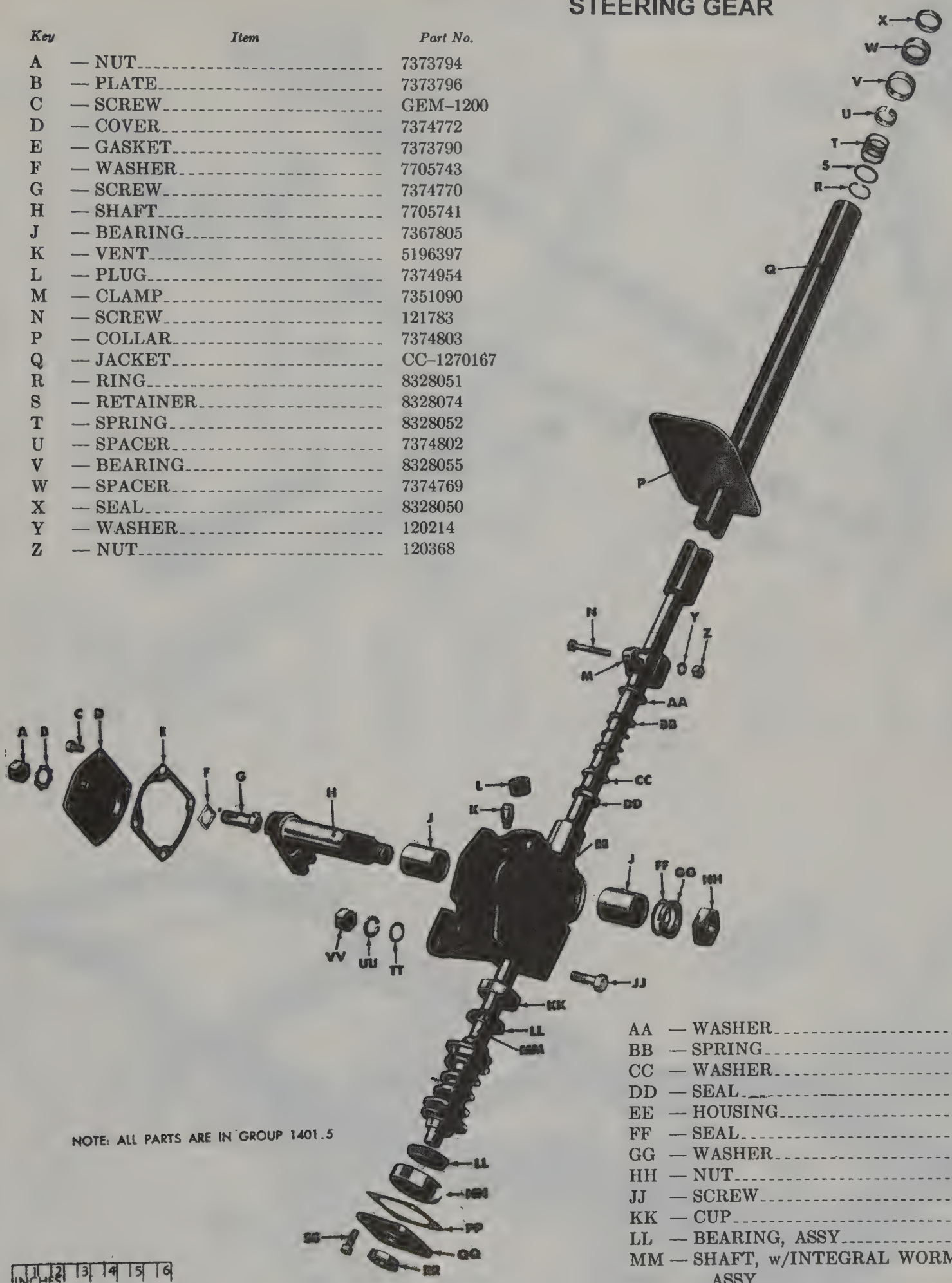
Key	*Item*	*Part No.*
A	— SEAL	7413017
B	— BUTTON	7373695
C	— SPRING	7348998
D	— PLATE	7373697
E	— RING	7348996
F	— SPRING	7348997
G	— NUT	7373795
H	— INSULATOR	CC–1314310
J	— WHEEL, ASSY	7374801
K	— PLATE, ASSY	GEM–B6116
L	— SEAL	7413018
M	— WASHER	446174
N	— TUBE	CC–1140885
P	— NUT	137399
Q	— HOSE	CC–1390016
R	— SHELL	7762628
S	— BUSHING	572999
T	— GROMMET	573005
U	— TERMINAL	572929
V	— CABLE	7720853
W	— PLATE	7373696
X	— RETAINER	UC–99235
Y	— CONTACT	UC–EX48–337



Removing steering wheel.

STEERING GEAR

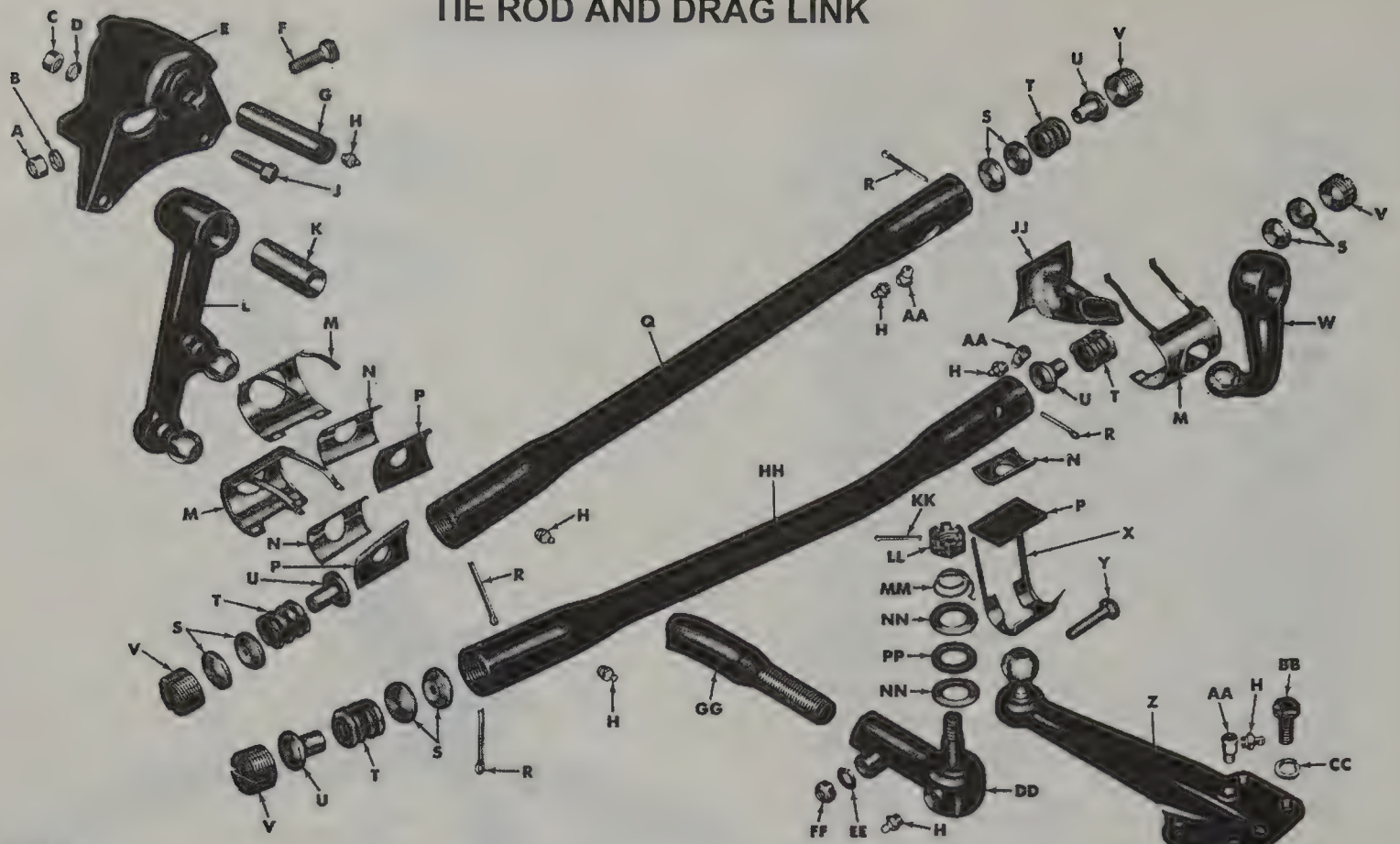
Key	*Item*	*Part No.*
A	— NUT	7373794
B	— PLATE	7373796
C	— SCREW	GEM–1200
D	— COVER	7374772
E	— GASKET	7373790
F	— WASHER	7705743
G	— SCREW	7374770
H	— SHAFT	7705741
J	— BEARING	7367805
K	— VENT	5196397
L	— PLUG	7374954
M	— CLAMP	7351090
N	— SCREW	121783
P	— COLLAR	7374803
Q	— JACKET	CC–1270167
R	— RING	8328051
S	— RETAINER	8328074
T	— SPRING	8328052
U	— SPACER	7374802
V	— BEARING	8328055
W	— SPACER	7374769
X	— SEAL	8328050
Y	— WASHER	120214
Z	— NUT	120368



NOTE: ALL PARTS ARE IN GROUP 1401.5

AA	— WASHER	7351093
BB	— SPRING	7351094
CC	— WASHER	7351092
DD	— SEAL	7373799
EE	— HOUSING	GEM–6113
FF	— SEAL	7375410
GG	— WASHER	7412197
HH	— NUT	7411905
JJ	— SCREW	123973
KK	— CUP	707075
LL	— BEARING, ASSY	705011
MM	— SHAFT, w/INTEGRAL WORM, ASSY	7705742
NN	— CUP	706624
PP	— SHIM	7413019
QQ	— COVER	7374775
RR	— SEAL	7373798
SS	— SCREW	7372665
TT	— WASHER	446248
UU	— WASHER	121574
VV	— NUT	121358

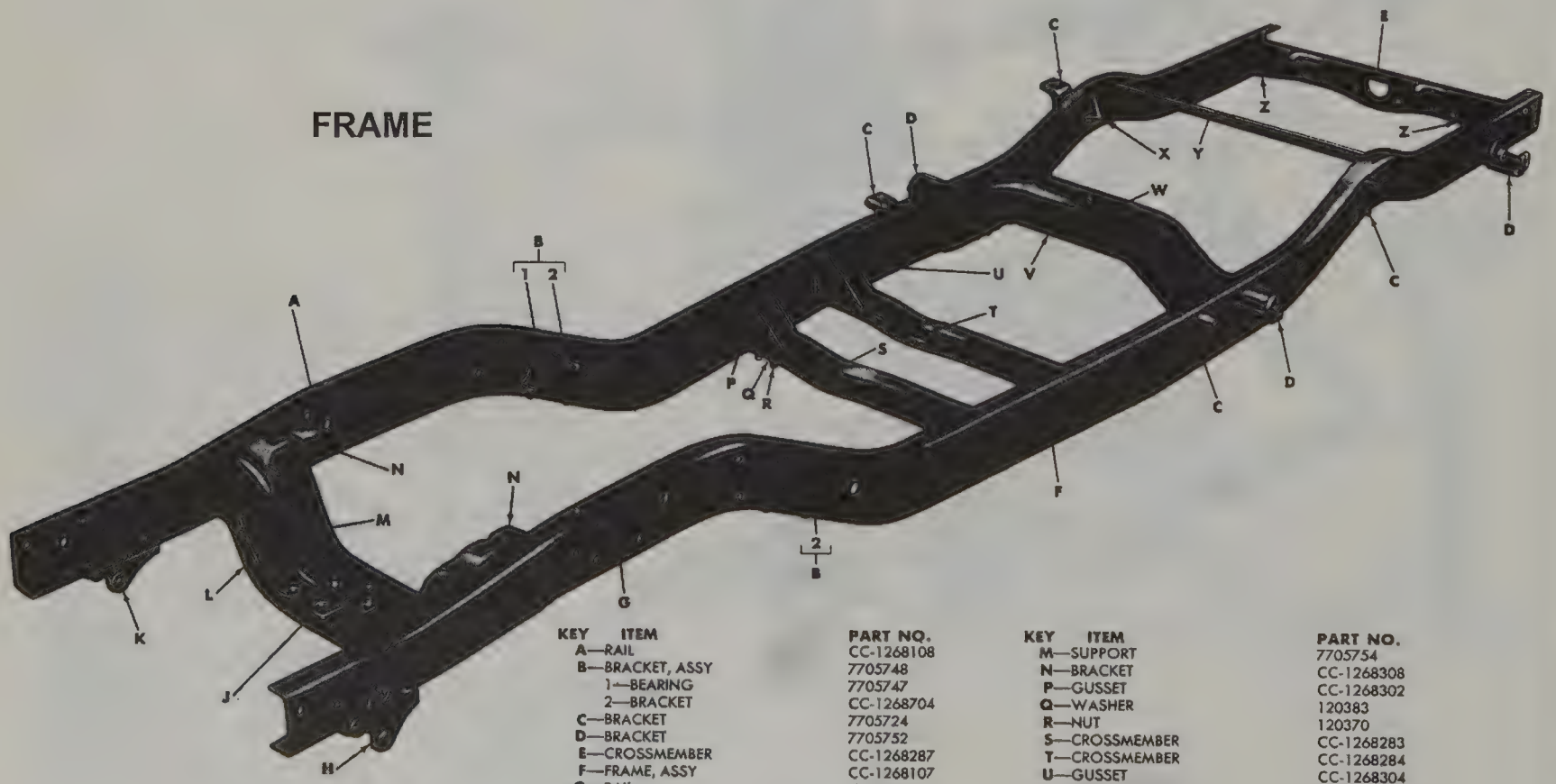
TIE ROD AND DRAG LINK



KEY	ITEM	PART NO	GROUP	KEY	ITEM	PART NO	GROUP	KEY	ITEM	PART NO	GROUP	KEY	ITEM	PART NO	GROUP
A	NUT	120369	1401.1	L	ARM, ASSY	7374765	1401.1	W	ARM	7373789	1401.5	GG	ROD	7373787	1401.3
B	WASHER	120382	1401.1	M	COVER	7342652	1401.1	X	RETAINER	7342863	1401.1	HH	TUBE, ASSY	7374762	1401.1
C	NUT	120371	1401.1	N	COVER	7342651	1401.1	Y	SCREW	181404	1401.3	JJ	COVER	7342653	1401.1
D	WASHER	120384	1401.1	P	SEAL	7342520	1401.1	Z	ARM	7342833	1004	KK	PIN	119209	1401.3
E	BRACKET	7374764	1401.1	Q	TUBE, ASSY	7374763	1401.1	AA	ELBOW	504202	1004	LL	NUT	7351054	1401.3
F	SCREW	120640	1401.1	R	PIN	103403	1401.1	BB	SCREW	7373746	1004	MM	SPRING	7351051	1401.3
G	SHAFT	7373786	1401.1	S	SEAT	7342835	1401.1	CC	WASHER	135629	1004	NN	WASHER	7351053	1401.3
H	FITTING	504208	1401.1-1401.3-1004	T	SPRING	A214406	1401.1	DD	END	A225884	1401.3	PP	COVER	7349087	1401.3
K	BEARING	7373785	1401.1	V	PLUG	7350290	1401.1	EE	WASHER	120383	1401.3				
J	SCREW	120424	1401.1	U	BUMPER	7342502	1401.1	FF	NUT	120370	1401.3				

RA PD 355495

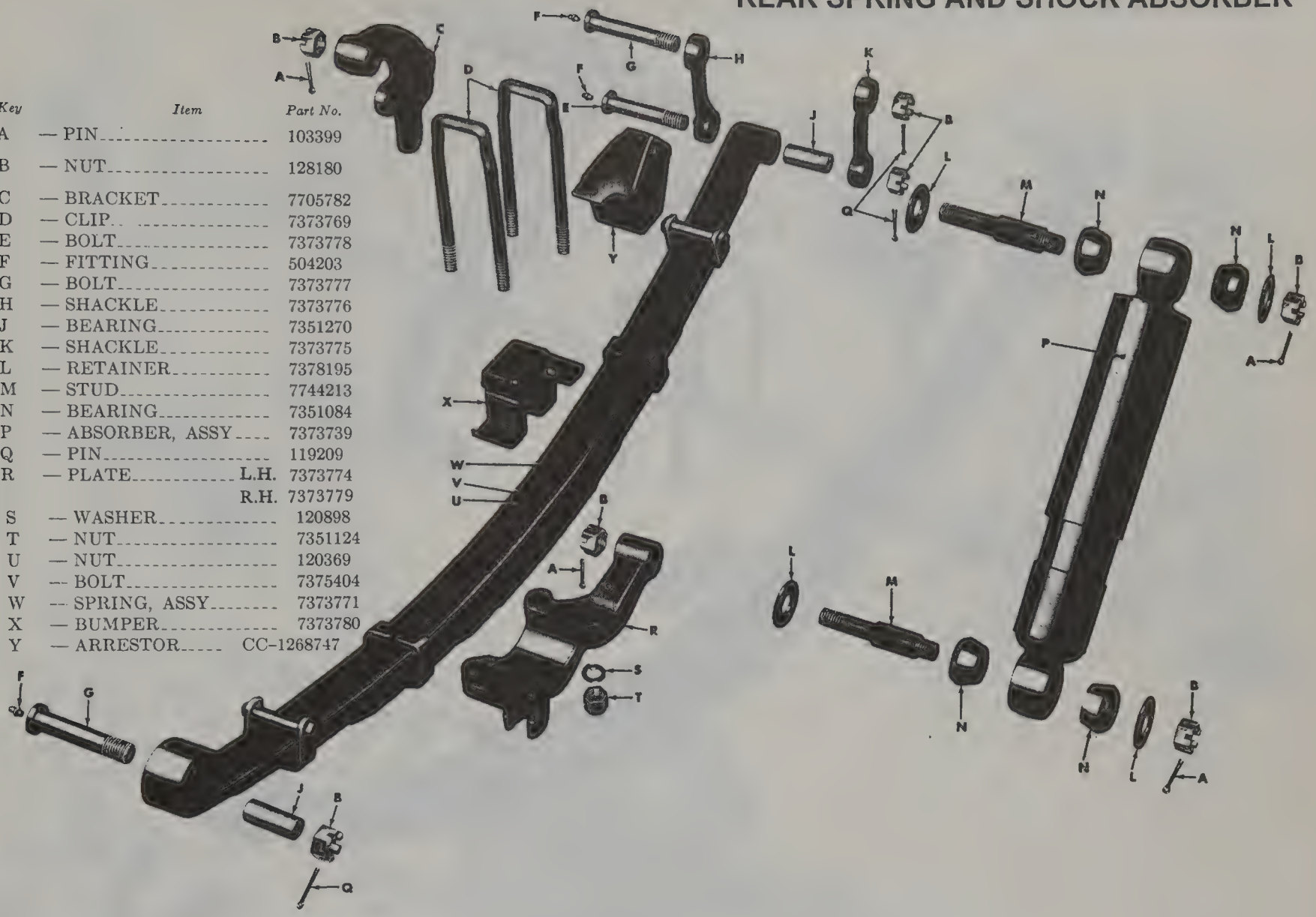
FRAME



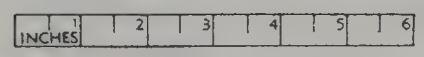
KEY	ITEM	PART NO.	KEY	ITEM	PART NO.
A	RAIL	CC-1268108	M	SUPPORT	7705754
B	BRACKET, ASSY	7705748	N	BRACKET	CC-1268308
1	BEARING	7705747	P	GUSSET	CC-1268302
2	BRACKET	CC-1268704	Q	WASHER	120383
C	BRACKET	7705724	R	NUT	120370
D	BRACKET	7705752	S	CROSSMEMBER	CC-1268283
E	CROSSMEMBER	CC-1268287	T	CROSSMEMBER	CC-1268284
F	FRAME, ASSY	CC-1268107	U	GUSSET	CC-1268304
G	RAIL	CC-1268109	V	REINFORCEMENT	CC-1268286
H	BRACKET	7705750	W	CROSSMEMBER	CC-1268285
J	BRACKET	CC-1268112	X	REINFORCEMENT	CC-1273760
K	BRACKET	7705751	Y	CROSSMEMBER	CC-1269321
L	REINFORCEMENT	CC-1268111	Z	BRACE	CC-1268288

REAR SPRING AND SHOCK ABSORBER

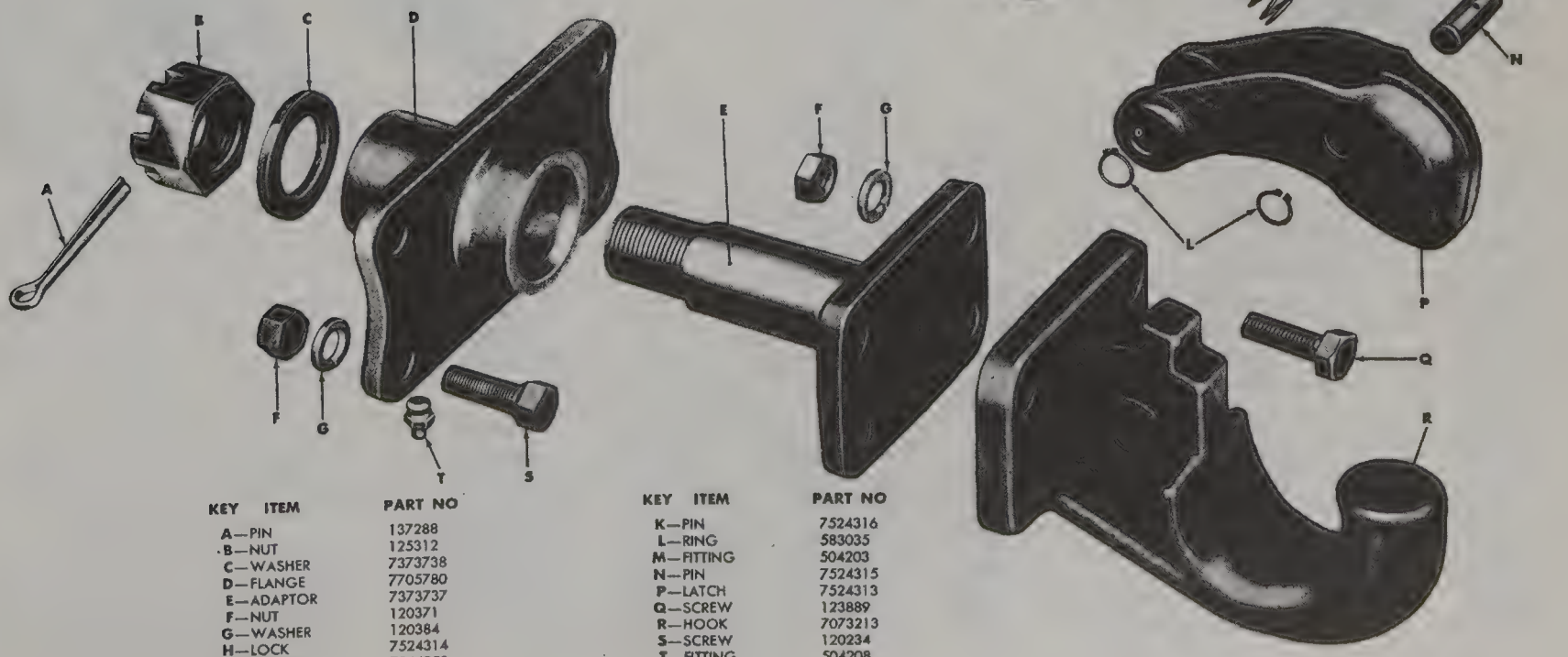
Key	Item		Part No.
A	— PIN		103399
B	— NUT		128180
C	— BRACKET		7705782
D	— CLIP		7373769
E	— BOLT		7373778
F	— FITTING		504203
G	— BOLT		7373777
H	— SHACKLE		7373776
J	— BEARING		7351270
K	— SHACKLE		7373775
L	— RETAINER		7378195
M	— STUD		7744213
N	— BEARING		7351084
P	— ABSORBER, ASSY		7373739
Q	— PIN		119209
R	— PLATE	L.H.	7373774
		R.H.	7373779
S	— WASHER		120898
T	— NUT		7351124
U	— NUT		120369
V	— BOLT		7375404
W	— SPRING, ASSY		7373771
X	— BUMPER		7373780
Y	— ARRESTOR		CC-1268747



PINTLE HOOK



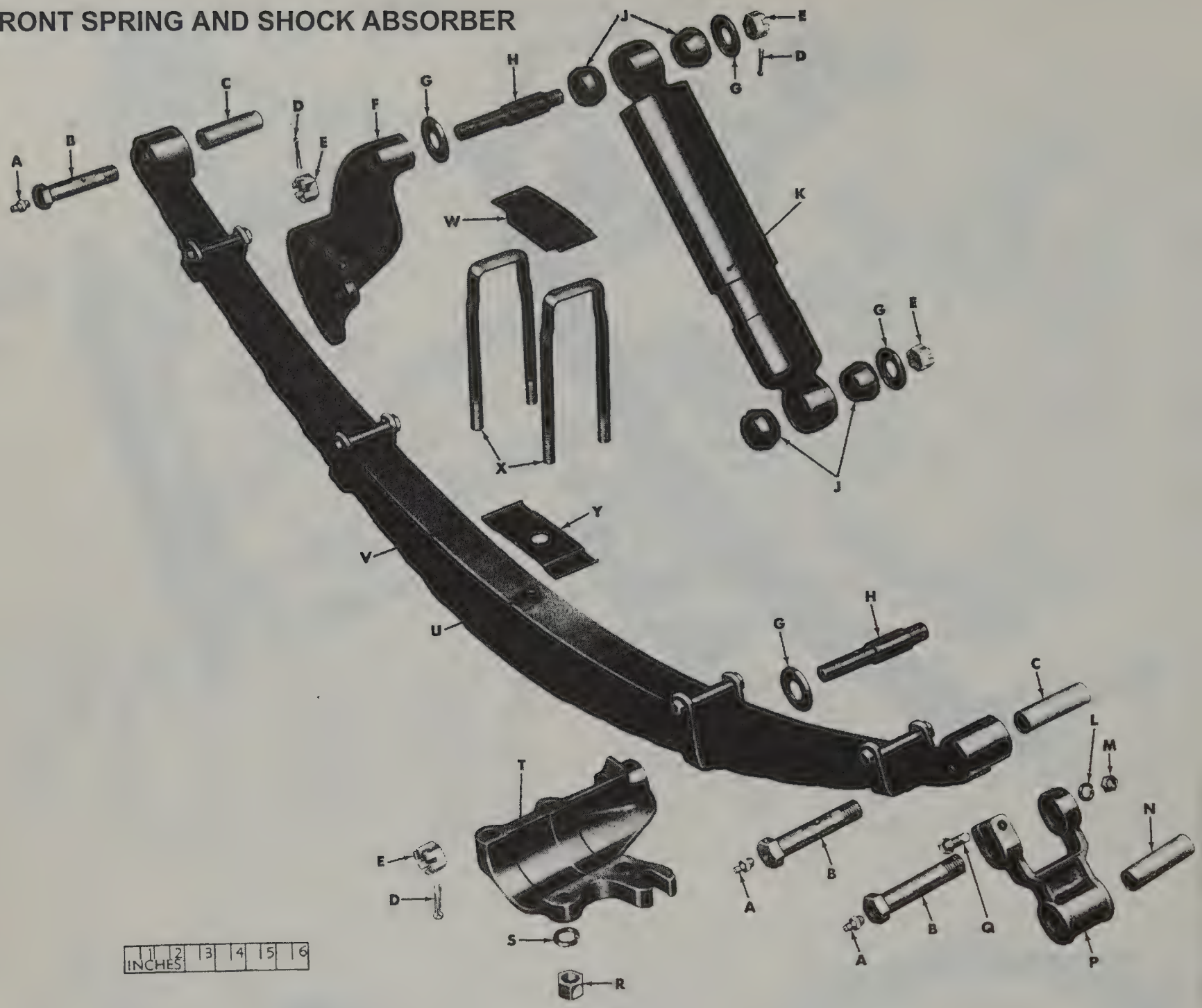
NOTE: ALL PARTS ARE IN GROUP 1503



KEY	ITEM	PART NO
A	—PIN	137288
B	—NUT	125312
C	—WASHER	7373738
D	—FLANGE	7705780
E	—ADAPTOR	7373737
F	—NUT	120371
G	—WASHER	120384
H	—LOCK	7524314
J	—SPRING	7044253

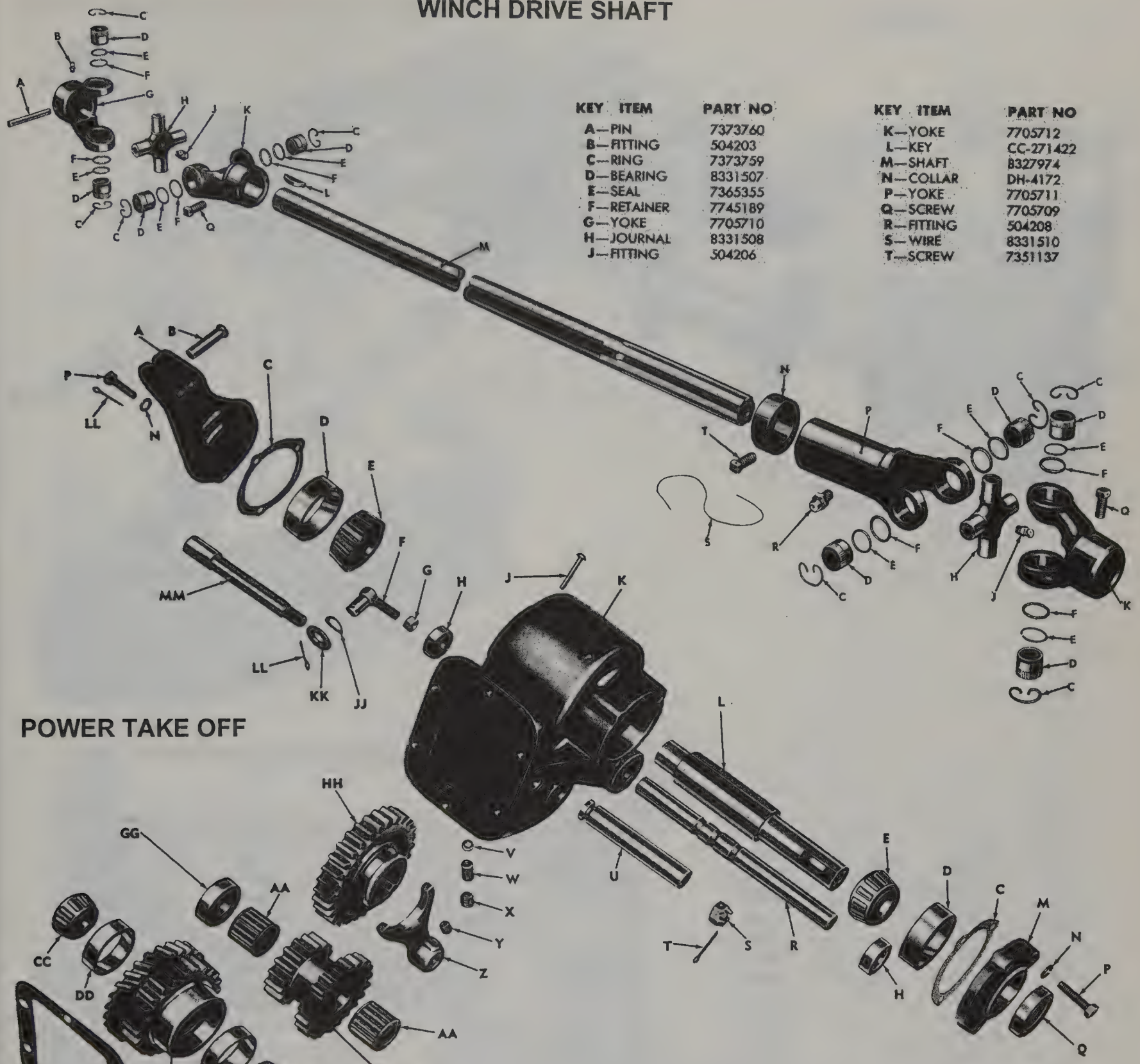
KEY	ITEM	PART NO
K	—PIN	7524316
L	—RING	583035
M	—FITTING	504203
N	—PIN	7524315
P	—LATCH	7524313
Q	—SCREW	123889
R	—HOOK	7073213
S	—SCREW	120234
T	—FITTING	504208

FRONT SPRING AND SHOCK ABSORBER



Key	Item	Part No.	
A	— FITTING	504208	
B	— BOLT	7373764	
C	— BEARING	7351270	
D	— PIN	103399	
E	— NUT	128180	
F	— BRACKET	7705785	
G	— RETAINER	7378195	
H	— STUD	7744213	
J	— BEARING	7351084	
K	— ABSORBER, ASSY	7373740	
L	— WASHER	120382	
M	— NUT	120369	
N	— BEARING	7351085	
P	— SHACKLE	CC-1268561	
Q	— SCREW	120640	
R	— NUT	7351124	
S	— WASHER	120898	
T	— PLATE R.H.	7373766	L.H. 7373767
U	— BOLT	7351213	
V	— SPRING, ASSY	7373761	
W	— BUMPER	7349091	
X	— CLIPS	7373768	
Y	— SEAT	7373765	

WINCH DRIVE SHAFT



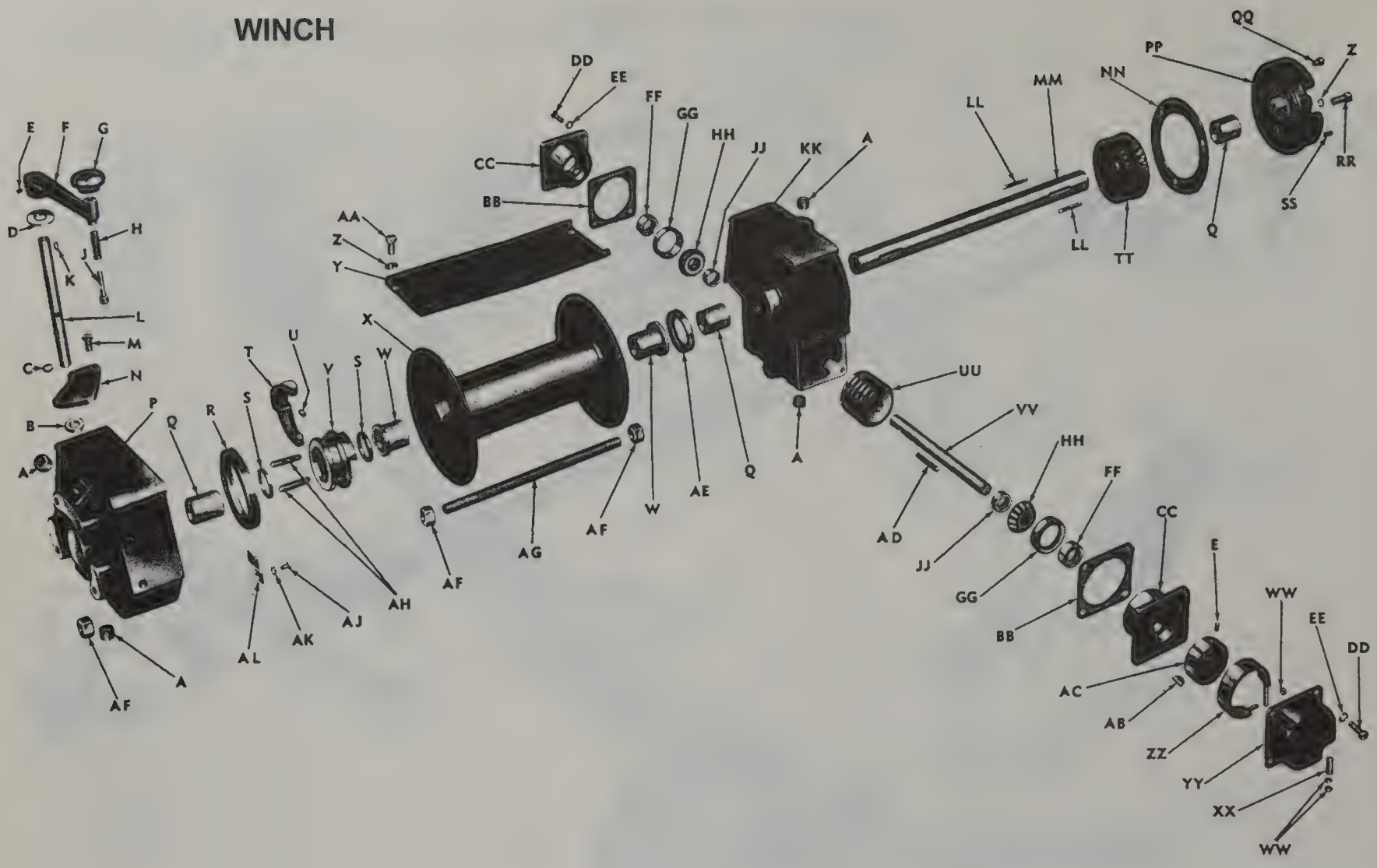
KEY	ITEM	PART NO
A	PIN	7373760
B	FITTING	504203
C	RING	7373759
D	BEARING	8331507
E	SEAL	7365355
F	RETAINER	7745189
G	YOKE	7705710
H	JOURNAL	8331508
J	FITTING	504206
K	YOKE	7705712
L	KEY	CC-271422
M	SHAFT	8327974
N	COLLAR	DH-4172
P	YOKE	7705711
Q	SCREW	7705709
R	FITTING	504208
S	WIRE	8331510
T	SCREW	7351137

POWER TAKE OFF

Key	Item	Part No.
A	PLATE	DH-6164D
B	PIN	7351267
C	GASKET	7351237
D	CUP	706744
E	CONE	705834
F	BOLT	DH-4114
G	NUT	120369
H	SEAL	500012
J	RIVET	105098
K	HOUSING	DH-12533
L	SHAFT	7374906
M	PLATE	7705786
N	WASHER	120214
P	SCREW	122007
Q	SEAL	7374812
R	SHAFT	7705755
S	NUT	125250
T	PIN	103399

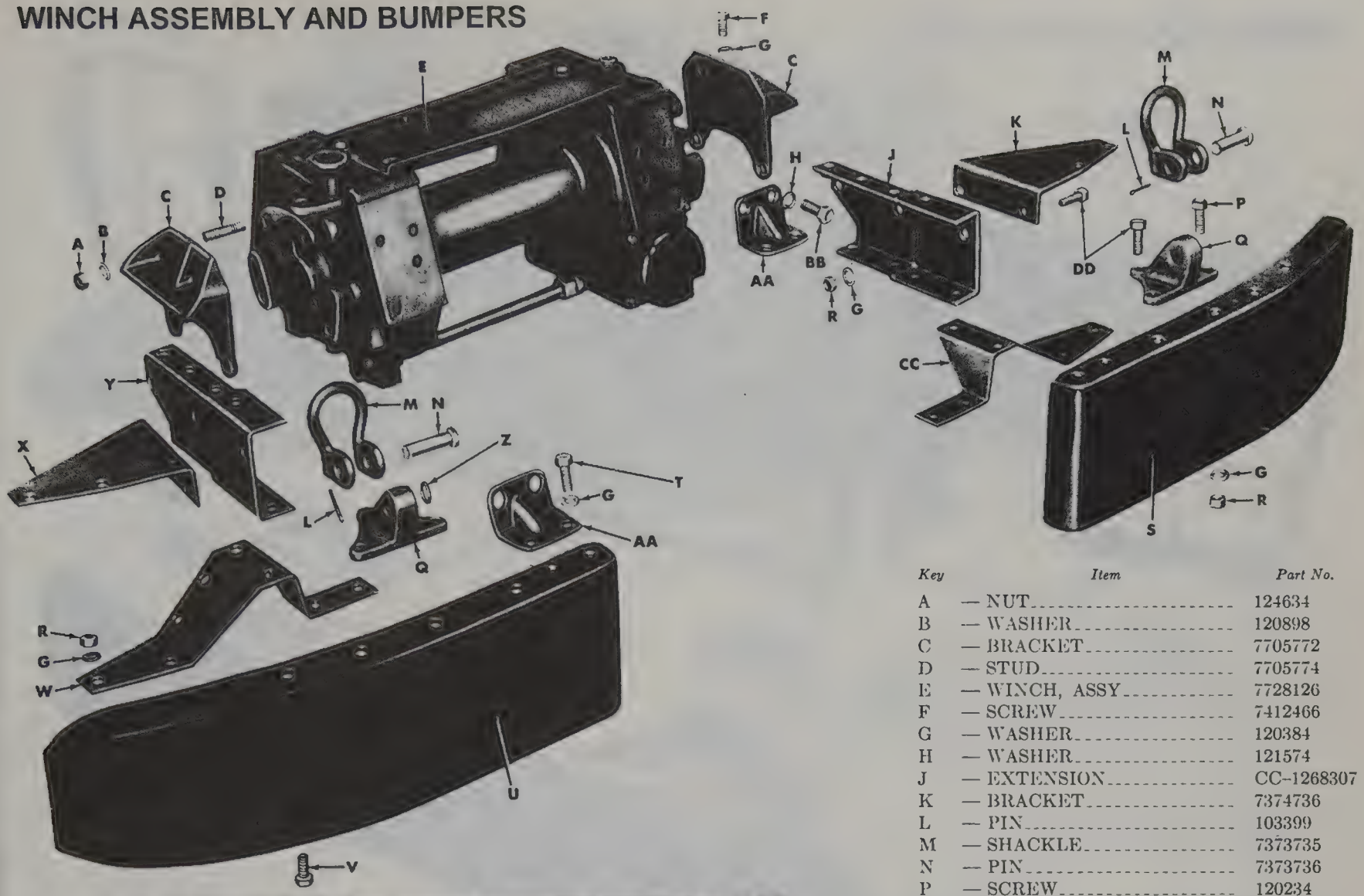
Key	Item	Part No.
U	SHAFT	7374905
V	BALL	104921
W	SPRING	7351140
X	PLUG	113935
Y	SCREW	139413
Z	FORK	7705757
AA	BEARING	708224
BB	GEAR	7351234
CC	CONE	705369
DD	CUP	707085
EE	GEAR	7374902
FF	GASKET	7351235
GG	SPACER	DH-12535
HH	GEAR	7705756
JJ	WASHER	7351139
KK	WASHER	120395
LL	PIN	119209
MM	SHAFT	7374904

WINCH

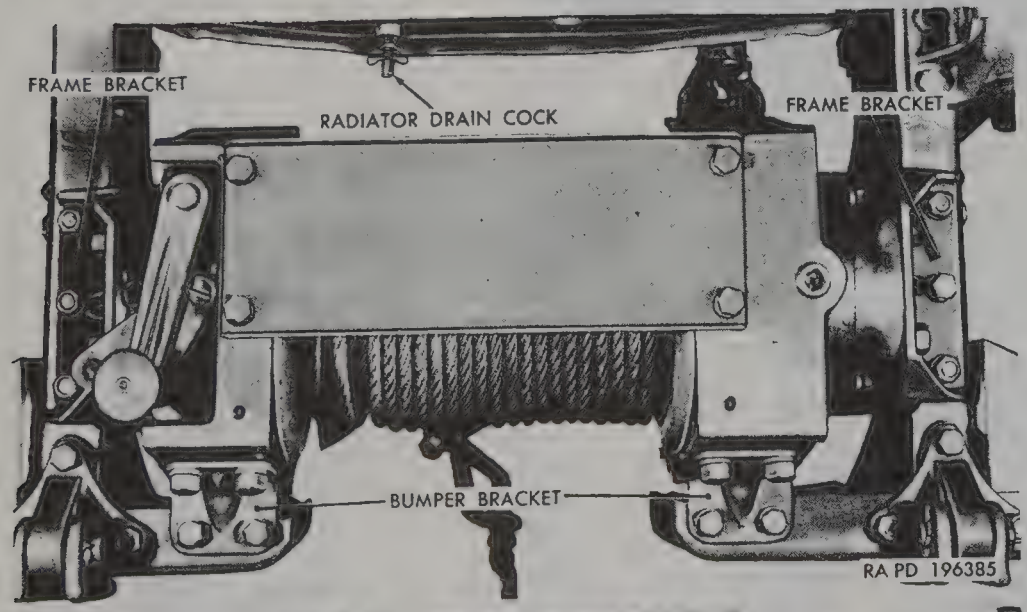


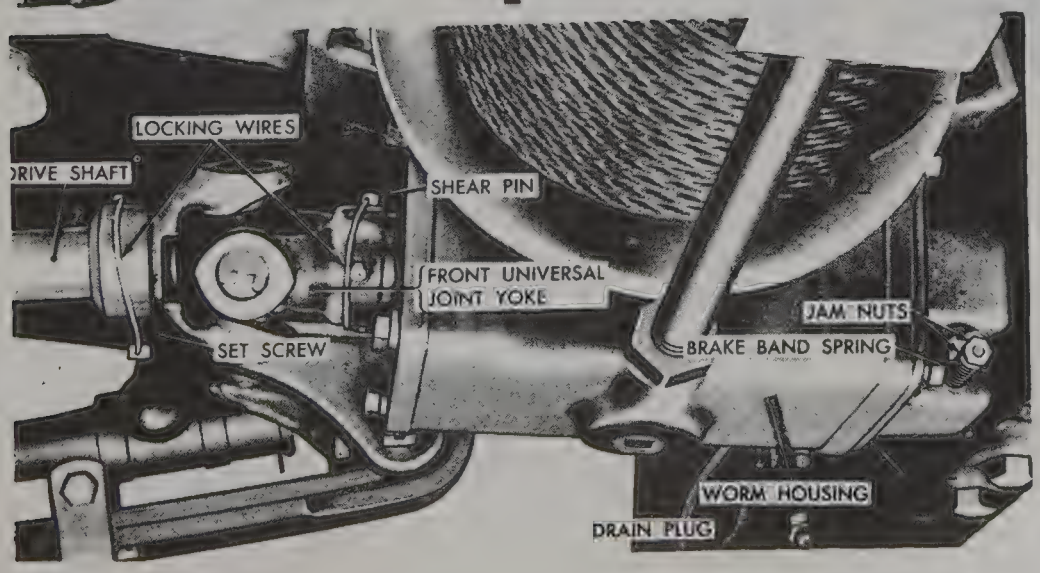
Key	Item	Part No.	Subgroup
A	— PLUG	7374954	2001.2
B	— SEAL	7374956	2001.2
C	— RING	7374955	2001.2
D	— WASHER	131017	2001.2
E	— SCREW	119504	2001.2
F	— HANDLE	BRA–LU4–143B	2001.2
G	— KNOB	7412420	2001.2
H	— SPRING	7412464	2001.2
J	— SHAFT	7412454	2001.2
K	— KEY	103905	2001.2
L	— SHAFT	7374958	2001.2
M	— SCREW	133906	2001.2
N	— PLATE	BRA–LU4–193C	2001.2
P	— HOUSING	BRA–LU4–133	2001.2
Q	— BEARING	7412403	2001.2
R	— SEAL	7413025	2001.2
S	— RING	7412456	2001.2
T	— FORK	7374953	2001.2
U	— SCREW	139077	2001.2
V	— CLUTCH	7374952	2001.2
W	— BEARING	7413023	2001.2
X	— DRUM, ASSY	BRA–LU4–135O	2001.2
Y	— PLATE	BRA–LU4–184A	2001.2
Z	— WASHER	120384	2001.2
AA	— SCREW	120426	2001.2
BB	— GASKET	5249623	2001.2
CC	— RETAINER	BRA–LU4–149	2001.2
DD	— SCREW	120918	2001.2
EE	— WASHER	120382	2001.2
FF	— SEAL	7374957	2001.2
GG	— CUP	706845	2001.2
HH	— CONE	705436	2001.2
JJ	— SPACER	7702756	2001.2
KK	— HOUSING	BRA–LU4–134	2001.2
LL	— KEY	7412419	2001.2
MM	— SHAFT	7374959	2001.2
NN	— GASKET	7413024	2001.2
PP	— COVER	BRA–LU4–144	2001.2
QQ	— VENT, ASSY	5196397	2001.2
RR	— SCREW	122433	2001.2
SS	— PLUG	143932	2001.2
TT	— GEAR	7412418	2001.2
UU	— WORM	7412468	2001.2
VV	— SHAFT	7378242	2001.2
WW	— NUT	120613	2001.2
XX	— SPRING	7412462	2001.2
YY	— HOUSING	7374951	2001.2
ZZ	— BAND, ASSY	7351201	2001.2
AB	— KEY	113782	2001.2
AC	— DRUM	7412415	2001.2
AD	— KEY	542607	2001.2
AE	— SEAL	7413022	2001.2
AF	— NUT	124595	2001.2
AG	— BAR	BRA–LU4–184B	2001.2
AH	— KEY	543038	2001.2
AJ	— SCREW	120628	2001.1
AK	— WASHER	120380	2001.1
AL	— BRAKE	8328017	2001.1

WINCH ASSEMBLY AND BUMPERS

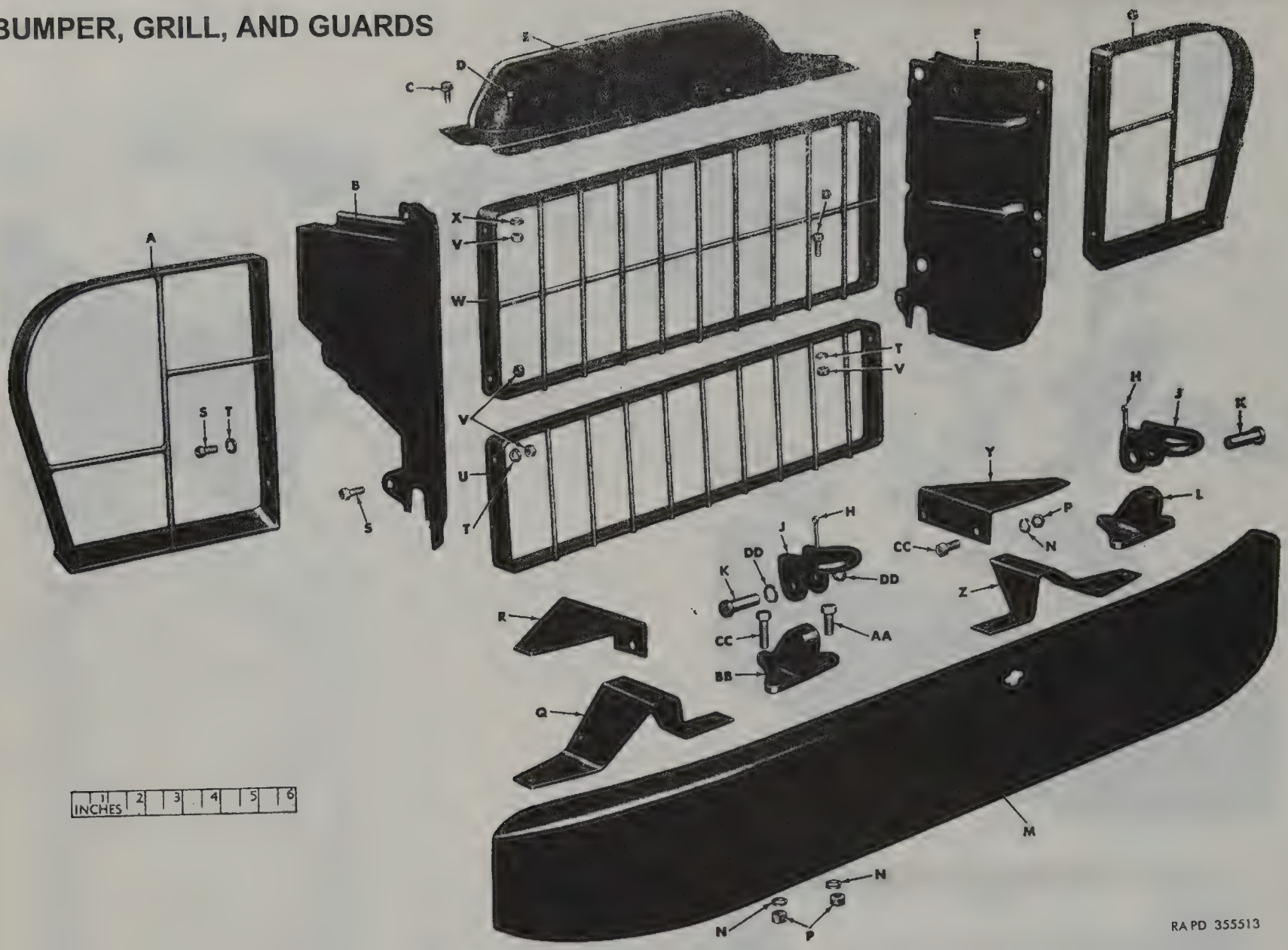


Key	*Item*	*Part No.*
A	— NUT	124634
B	— WASHER	120898
C	— BRACKET	7705772
D	— STUD	7705774
E	— WINCH, ASSY	7728126
F	— SCREW	7412466
G	— WASHER	120384
H	— WASHER	121574
J	— EXTENSION	CC–1268307
K	— BRACKET	7374736
L	— PIN	103399
M	— SHACKLE	7373735
N	— PIN	7373736
P	— SCREW	120234
Q	— BRACKET	7705779
R	— NUT	120371
S	— BUMPER	7374741
T	— SCREW	123605
U	— BUMPER	7374740
V	— SCREW	120424
W	— BRACKET	7374737
X	— BRACKET	7374735
Y	— EXTENSION	CC–1268306
Z	— SPACER	7705781
AA	— BRACKET	7705773
BB	— SCREW	122724
CC	— BRACKET	7374738





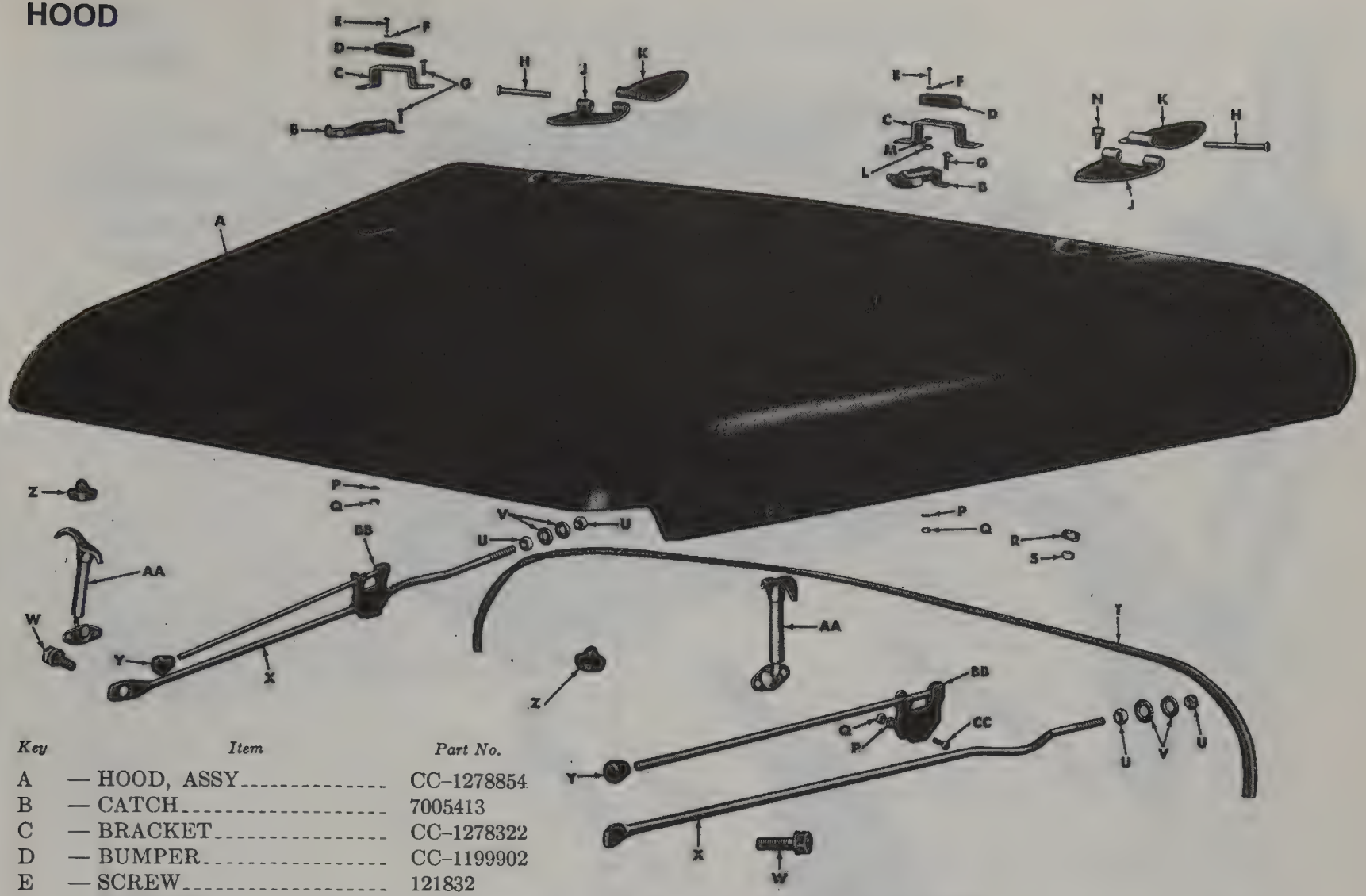
BUMPER, GRILL, AND GUARDS



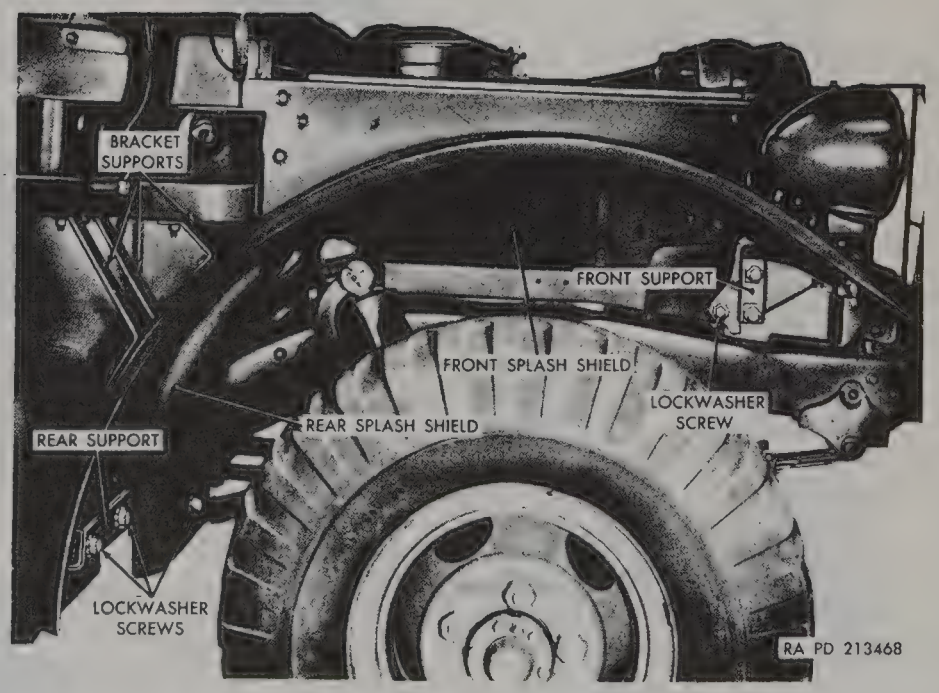
Key	Item	Part No.	Subgroup
A	— GUARD	7374732	2101
B	— SUPPORT	7374729	2101
C	— SCREW, ASSY	7351288	2101
D	— SCREW	120647	2101
E	— BAFFLE	7413236	2101
F	— SUPPORT	7374730	2101
G	— GUARD	7374731	2101
H	— PIN	103399	1503
J	— SHACKLE	7373735	1503
K	— PIN	7373736	1503
L	— BRACKET	7705779	1503
M	— BUMPER	7374734	2101
N	— WASHER	120384	1503
P	— NUT	120371	1503

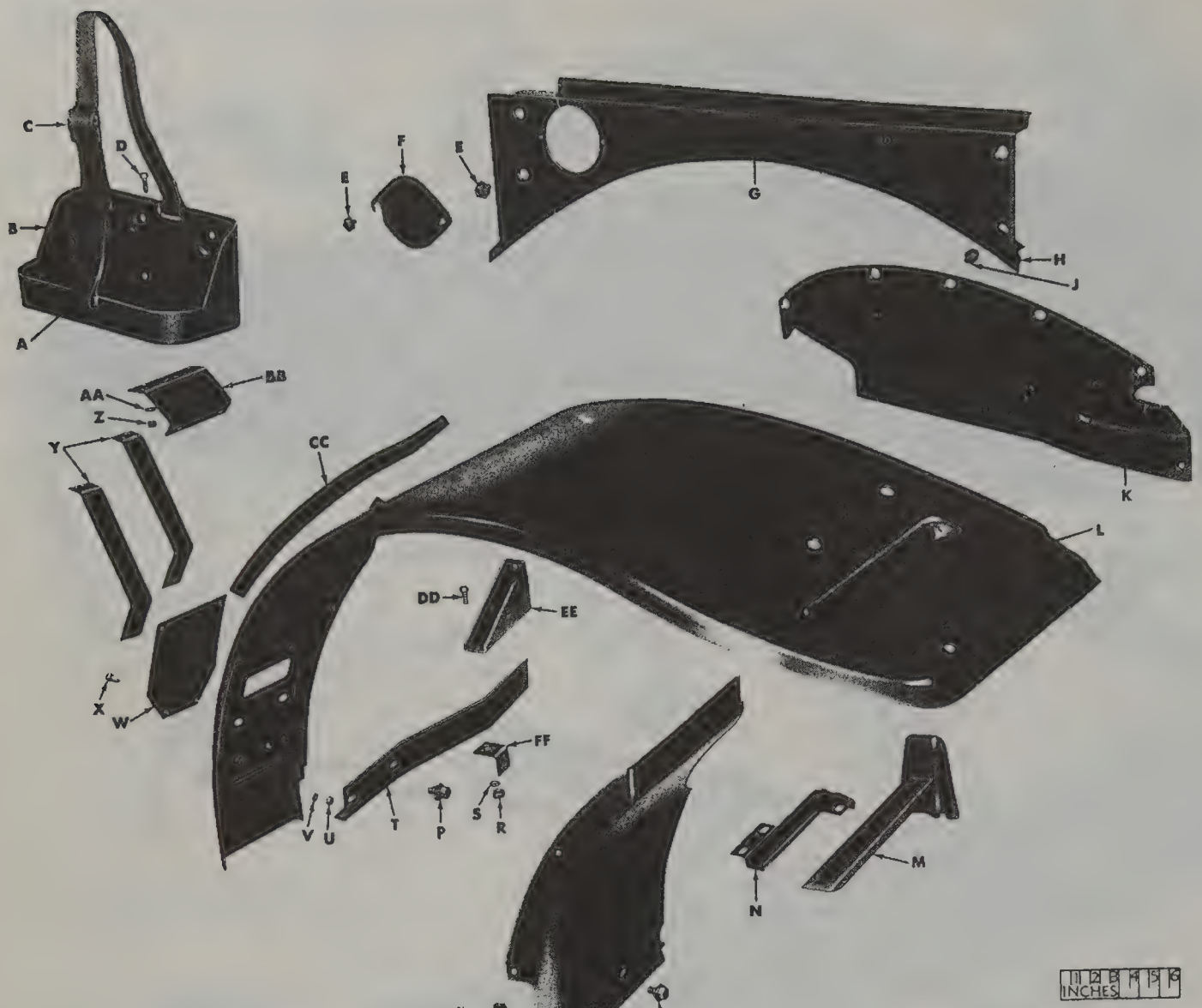
Key	Item	Part No.	Subgroup
Q	— BRACKET	7374737	2101
R	— BRACKET	7374735	2101
S	— SCREW	121615	2101
T	— WASHER	120382	2101
U	— EXTENSION	7374733	2101
V	— NUT	120369	2101
W	— GUARD	7374739	2101
X	— WASHER	7374728	2101
Y	— BRACKET	7374736	2101
Z	— BRACKET	7374738	2101
AA	— SCREW	120234	1503
BB	— BRACKET	7705779	1503
CC	— SCREW	120424	1503
DD	— SPACER	7705781	1503

HOOD

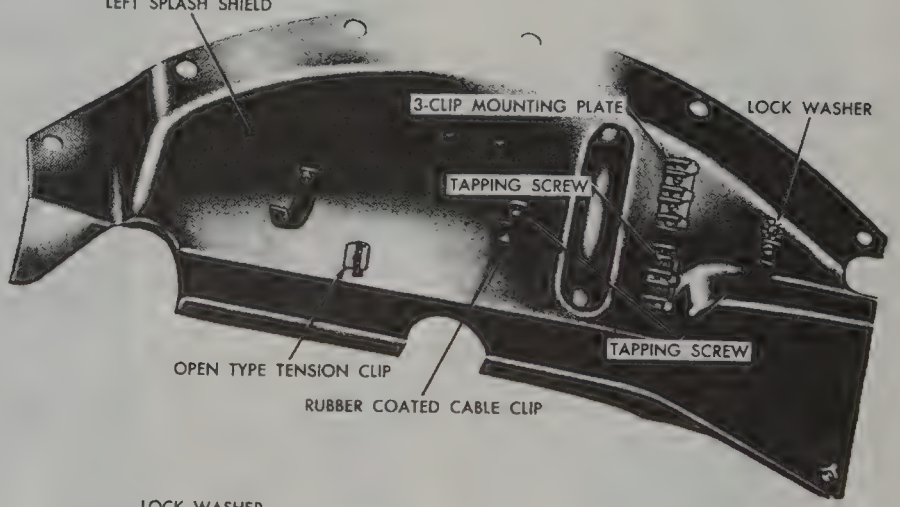


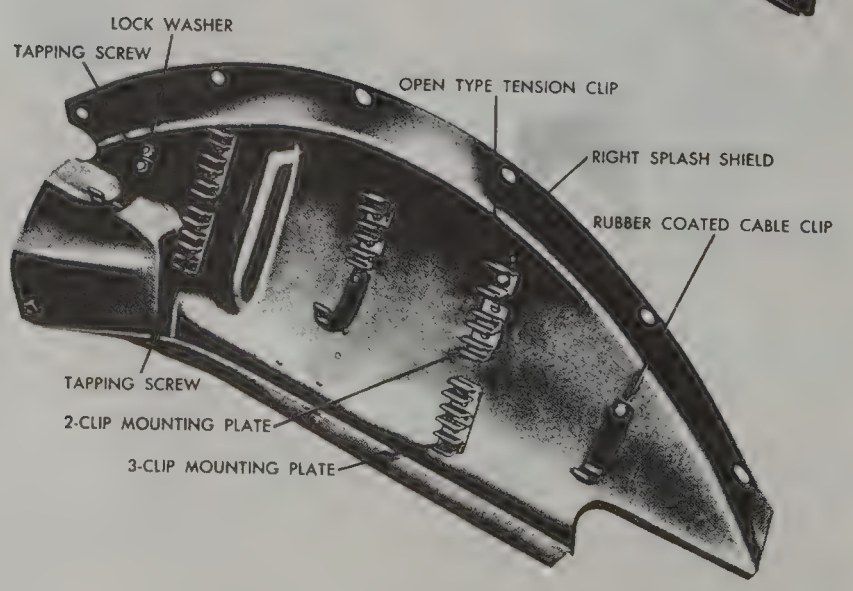
Key	Item	Part No.
A	— HOOD, ASSY	CC–1278854
B	— CATCH	7005413
C	— BRACKET	CC–1278322
D	— BUMPER	CC–1199902
E	— SCREW	121832
F	— WASHER	131015
G	— SCREW	CC–151374
H	— PIN	7373388
J	— HINGE	7372602
K	— HINGE	CC–1279142
L	— NUT	120622
M	— WASHER	121841
N	— SCREW, ASSY	7372600
P	— WASHER	120380
Q	— NUT	120367
R	— WASHER	7374728
S	— NUT	120369
T.	— LACING	CC–1244408
U	— NUT	120370
V	— WASHER	120390
W	— SCREW, ASSY	7007269
X	— ROD	7005435
Y	— BUMPER	7705776
Z	— BUMPER	7705775
AA	— LOCK, ASSY	7705777
BB	— SUPPORT, ASSY	7705778
CC	— SCREW	123461



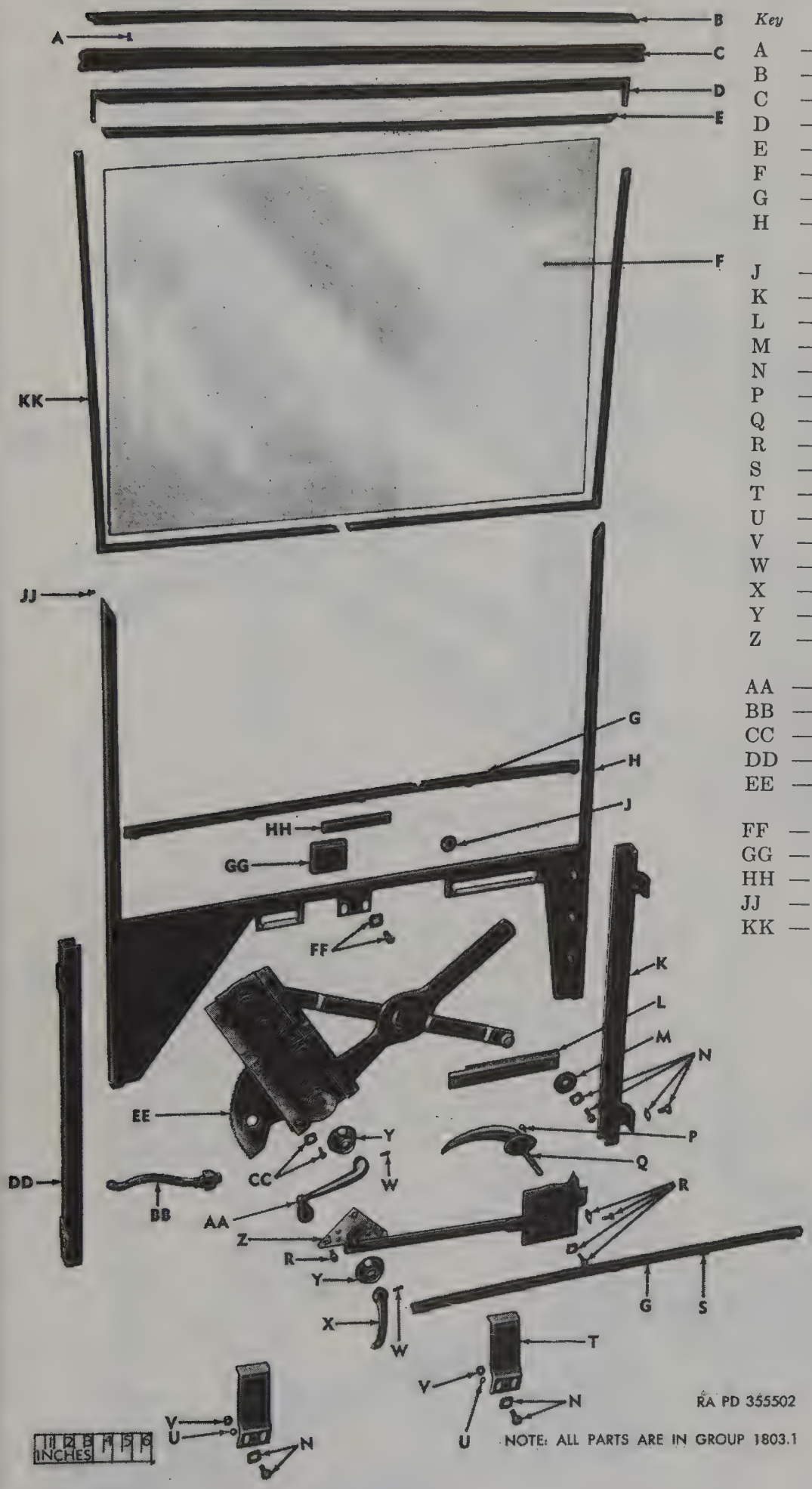


Key	Item	Part No.
A	— STRAP, ASSY	7064507
B	— BRACKET	7064504
C	— STRAP, ASSY	7064509
D	— SCREW	120647
E	— SCREW, ASSY	7707254
F	— COVER	7005426
G	— PANEL	CC–1277036
H	— FILLER	7375405
J	— SCREW, ASSY	7351288
K	— SHIELD	7707263
L	— FENDER, ASSY	7707256
M	— SUPPORT	7707268
N	— COVER	CC–1273352
P	— SCREW, ASSY	7707266
Q	— SHIELD	CC–1278734
R	— NUT	120370
S	— WASHER	120383
T	— SUPPORT	7707265
U	— NUT	120368
V	— WASHER	7350351
W	— COVER	CC–1279951
X	— SCREW	120741
Y	— SUPPORT	7705796
Z	— NUT	120369
AA	— WASHER	120382
BB	— SUPPORT	8328079 7705795
CC	— FILLER	CC–1278024
DD	— SCREW	123567
EE	— BRACKET	7707252
FF	— BRACKET	7374948



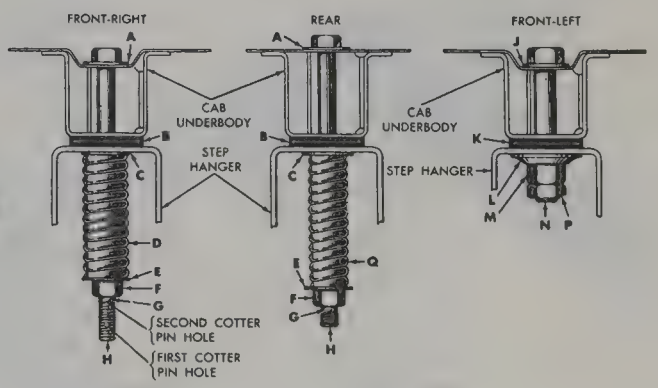


SIDE WINDOW, REGULATOR, AND RUNS



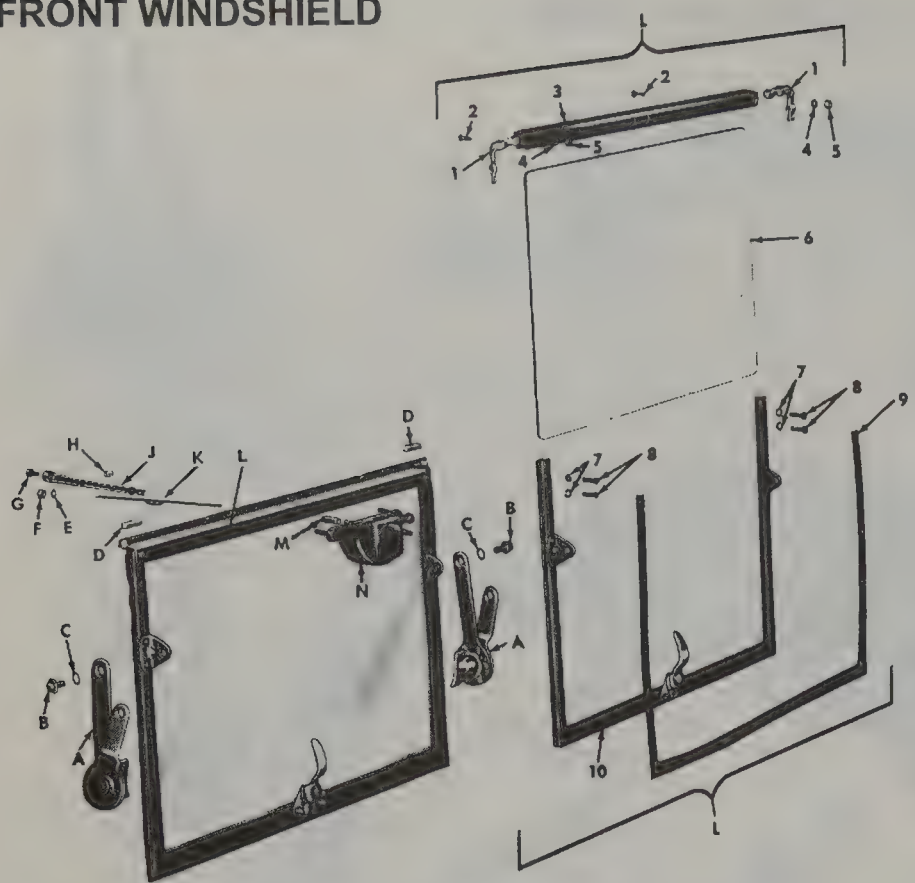
NOTE: ALL PARTS ARE IN GROUP 1803.1

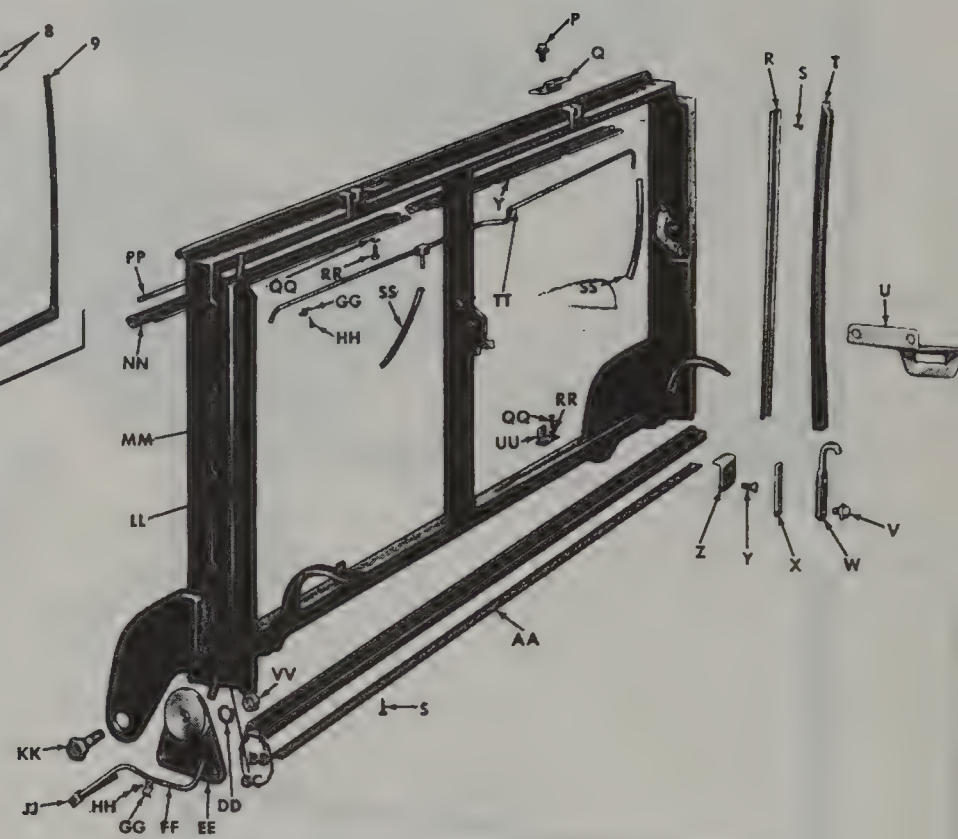
Key	Item		Part No.
A	— SCREW		188076
B	— RETAINER		7374834
C	— WEATHER STRIP		7374828
D	— CHANNEL		7374839
E	— FILLER		CC–1279925
F	— GLASS		CC–1277621
G	— WEATHER STRIP, ASSY		7374795
H	— CHANNEL	RIGHT	7374789
		LEFT	7374790
J	— RETAINER		7346914
K	— CHANNEL		7375408
L	— BRACKET		7374836
M	— WASHER		7346905
N	— SCREW, ASSY		7374835
P	— SCREW		CC–134289
Q	— HANDLE		7373744
R	— SCREW, ASSY		7374777
S	— FASTENER		7374840
T	— STOP		CC–1277636
U	— WASHER		7350351
V	— NUT		120368
W	— PIN		7348978
X	— HANDLE		7374745
Y	— ESCUTCHEON		7374785
Z	— LOCK, ASSY	RIGHT	7374787
		LEFT	7374788
AA	— HANDLE		7374797
BB	— ARM, ASSY		7346912
CC	— SCREW, ASSY		7005433
DD	— CHANNEL		7374830
EE	— REGULATOR, ASSY	RIGHT	7374783
		LEFT	7374784
FF	— SCREW, ASSY		7374838
GG	— STOP		CC–1278281
HH	— SPACER		CC–1279799
JJ	— SCREW		155886
KK	— FILLER		7374792



Cab holddown bolts and related parts.

FRONT WINDSHIELD

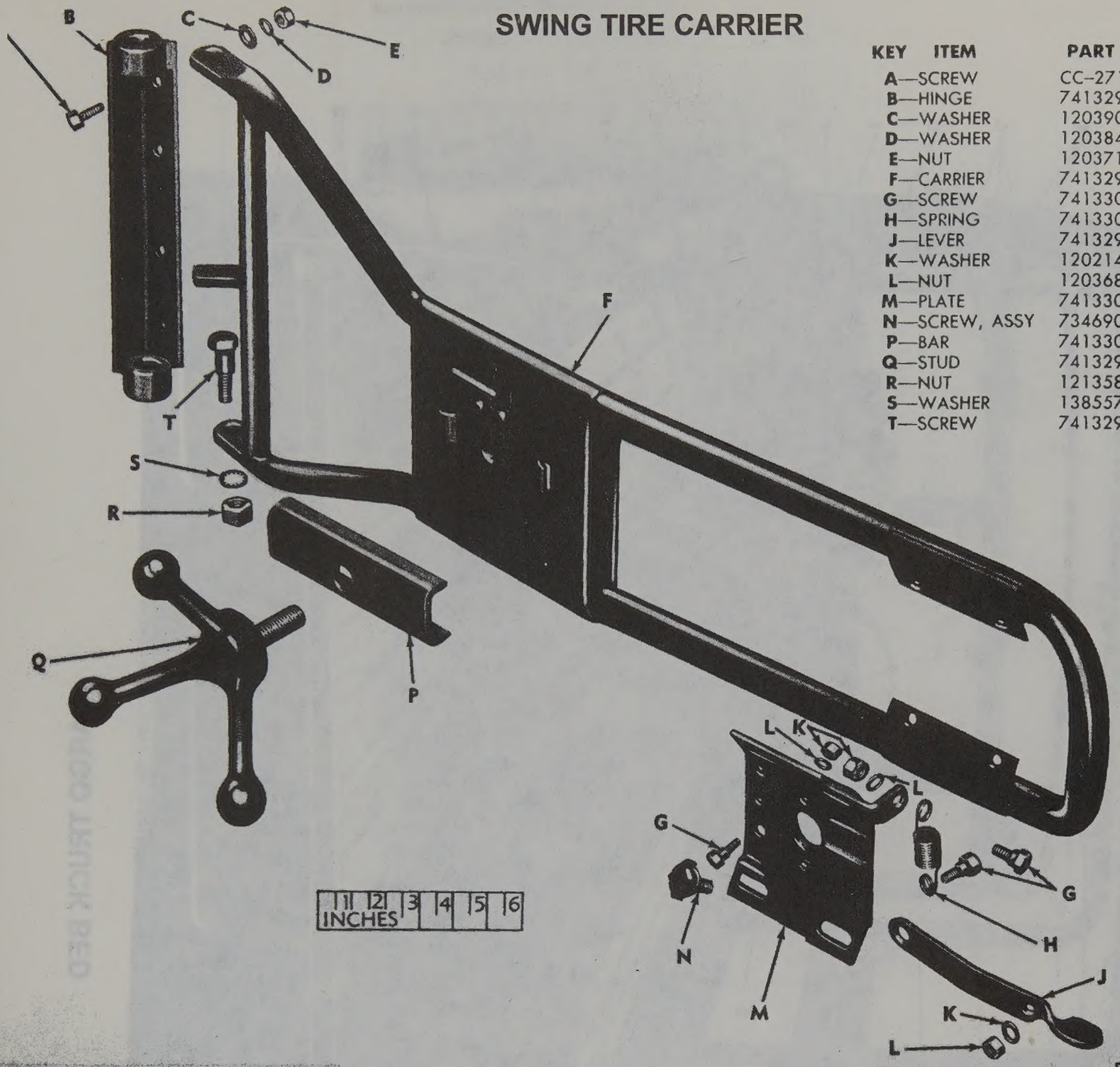




Key	Item	Part No.	Subgroup
A	— ARM	7373327	1804
B	— SCREW, ASSY	7994146	1804
C	— WASHER	7371886	1804
D	— WEATHER SEAL	AN–R758	1804
E	— WASHER	120217	2202
F	— NUT	120614	2202
G	— NUT	7349286	2202
H	— ADAPTER	7703745	2202
J	— ARM, ASSY	500810	2202
K	— BLADE	500814	2202
L	— WINDSHIELD, ASSY	7005417	1804
	1—PLUG	AN–SA–4893	1804
	2—SCREW	7324775	1804
	3—CROSSPIECE	CC–1277734	1804
	4—WASHER	138479	1804
	5—NUT	187312	1804
	6—GLASS	CC–1277732	1804
	7—WASHER	138530	1804
	8—SCREW	7324773	1804
	9—WEATHER STRIP	7374752	1804
	10—UNIT	CC–1277714	1804
M	— SPACER	7005434	2202
N	— MOTOR, ASSY	500844	2202
P	— SCREW, ASSY	7351288	1804
Q	— BRACKET	CC–1278252	1804
R	— RETAINER	7005420	1803.1
S	— SCREW	446556	1803.1

Key	Item	Part No.	Subgroup
T	— WEATHER STRIP	7005423	1803.1
U	— BRACKET	7346901	1804
V	— SCREW, ASSY	7372600	1804
W	— BRACKET	7349101	1804
X	— PLATE	CC–991253	1804
Y	— SCREW	120741	1804
Z	— STOP	7374811	1804
AA	— RETAINER	7005419	1804
BB	— WEATHER STRIP	7005424	1804
CC	— HOSE	CC–1271728	2202
DD	— WASHER	120898	1804
EE	— BRACKET	7374813	1804
FF	— TUBE	CC–1271726	2202
GG	— CLIP	7005431	2202
HH	— SCREW	125978	2202
JJ	— ELBOW	7372611	2202
KK	— SCREW	CC–1277900	1804
LL	— WEATHER STRIP	7005425	1803.1
MM	— FRAME, ASSY	7005416	1804
NN	— HINGE	7373323	1804
PP	— WEATHER SEAL	CC–1279333	1804
QQ	— WASHER	138479	1804
RR	— SCREW	AN–X1937	1804
SS	— HOSE	CC–628868	2202
TT	— TUBE	CC–1271724	2202
UU	— BRACKET	CC–1277735	1804
VV	— NUT	124634	1804

SWING TIRE CARRIER



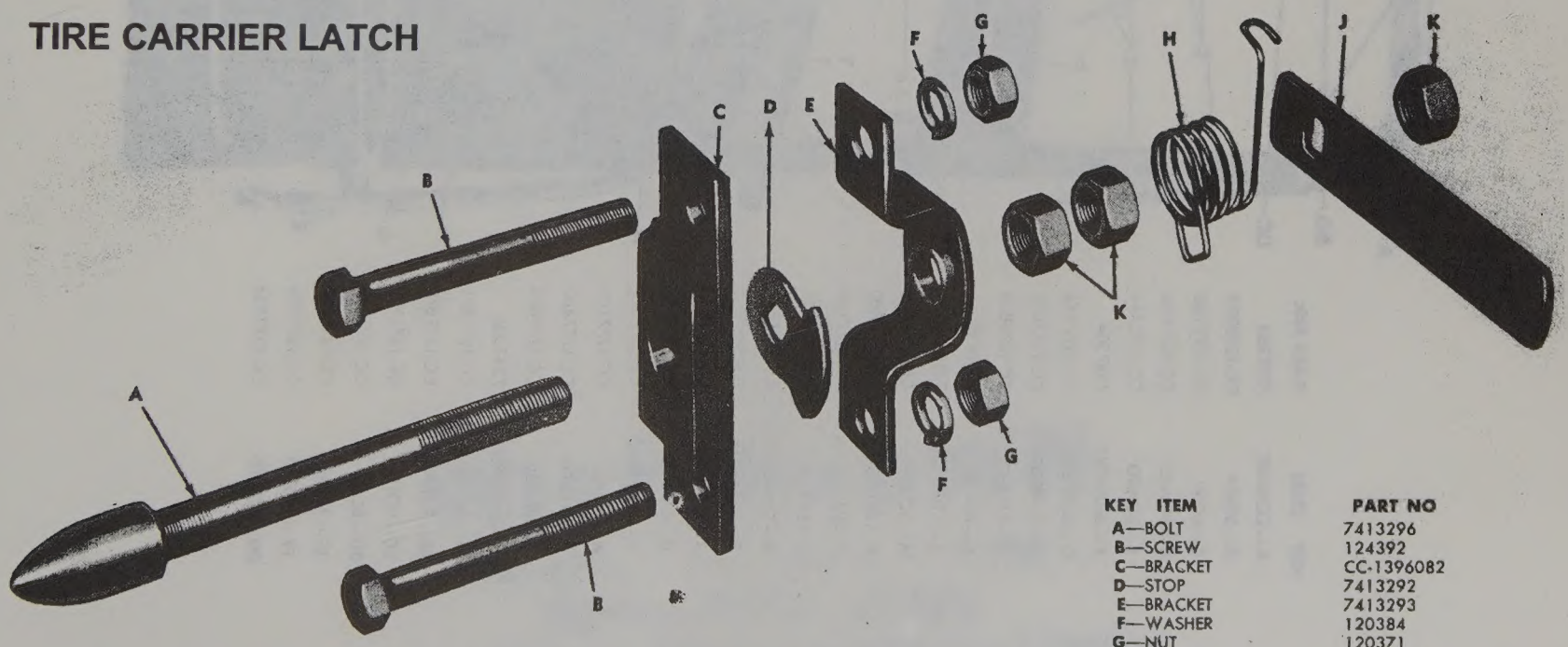
KEY	ITEM	PART NO
A	—SCREW	CC-271196
B	—HINGE	7413295
C	—WASHER	120390
D	—WASHER	120384
E	—NUT	120371
F	—CARRIER	7413294
G	—SCREW	7413303
H	—SPRING	7413300
J	—LEVER	7413298
K	—WASHER	120214
L	—NUT	120368
M	—PLATE	7413302
N	—SCREW, ASSY	7346907
P	—BAR	7413301
Q	—STUD	7413290
R	—NUT	121358
S	—WASHER	138557
T	—SCREW	7413291

INCHES 11 12 3 4 5 6

NOTE: ALL PARTS ARE IN GROUP 1812.12

RA PD 355467

TIRE CARRIER LATCH

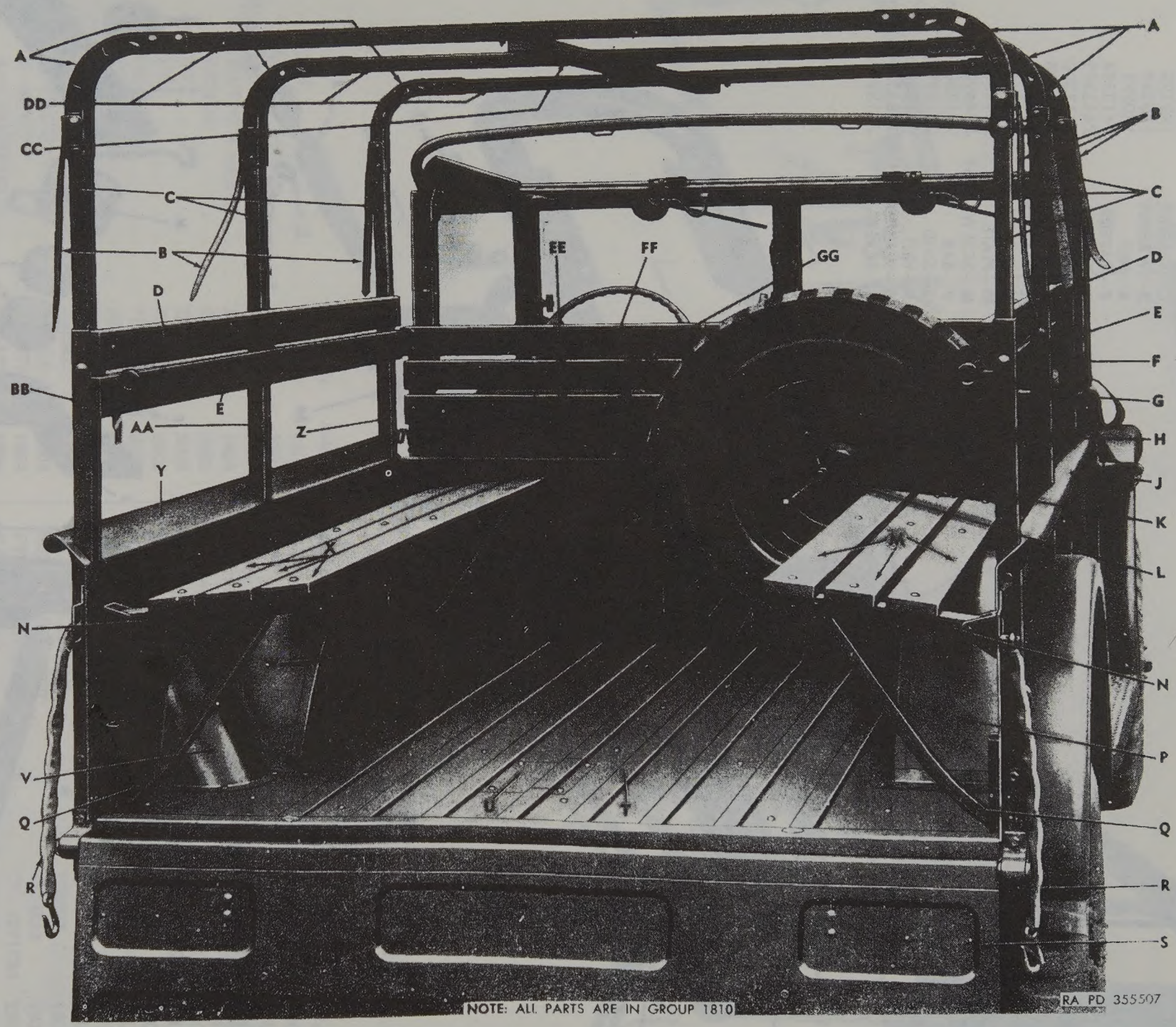


KEY	ITEM	PART NO
A	—BOLT	7413296
B	—SCREW	124392
C	—BRACKET	CC-1396082
D	—STOP	7413292
E	—BRACKET	7413293
F	—WASHER	120384
G	—NUT	120371
H	—SPRING	7413297
J	—HANDLE	7413299
K	—NUT	121358

INCHES 11 12 3 4 5 6

NOTE: ALL PARTS ARE IN GROUP 1812.12

KEY	ITEM	PART NO.
A	CORNER	7707285
B	STRAP	CC-1278029
C	BOW	CC-1277120
D	BOARD	CC-1277746
E	BOARD	CC-1277744
F	SUPPORT	7347504
G	SUPPORT	CC-1277874
H	SUPPORT	CC-1277878
J	PANEL	CC-1276803
K	PLATE	7350285
L	STUD	7413290
M	BOARD	CC-1277459
N	SUPPORT	CC-1276860
P	PANEL	CC-1277108
Q	BRACE	CC-1278051
R	CHAIN, ASSY	CC-1278329
S	TAILGATE	7005437
T	PANEL	CC-1277570
U	COVER	CC-1277517
V	HOUSING	CC-1277677
W	PANEL	CC-1277109
X	BOARD	CC-1277460
Y	PANEL	CC-1276804
Z	SUPPORT	7347505
AA	SUPPORT	CC-1277875
BB	SUPPORT	CC-1277879
CC	POLE	CC-1277124
DD	BOW	CC-1277122
EE	PANEL	CC-1276838
FF	BOARD	CC-1277535
GG	BOARD	CC-1277534



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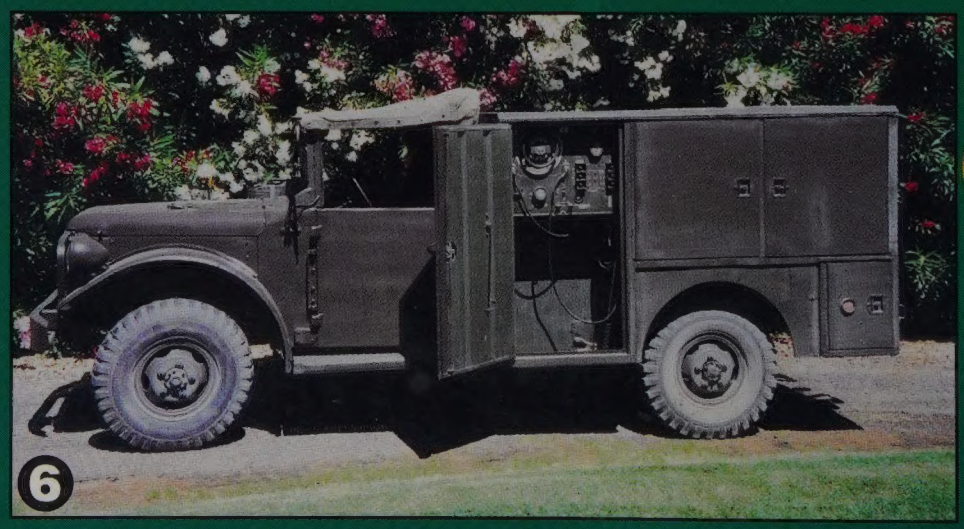
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